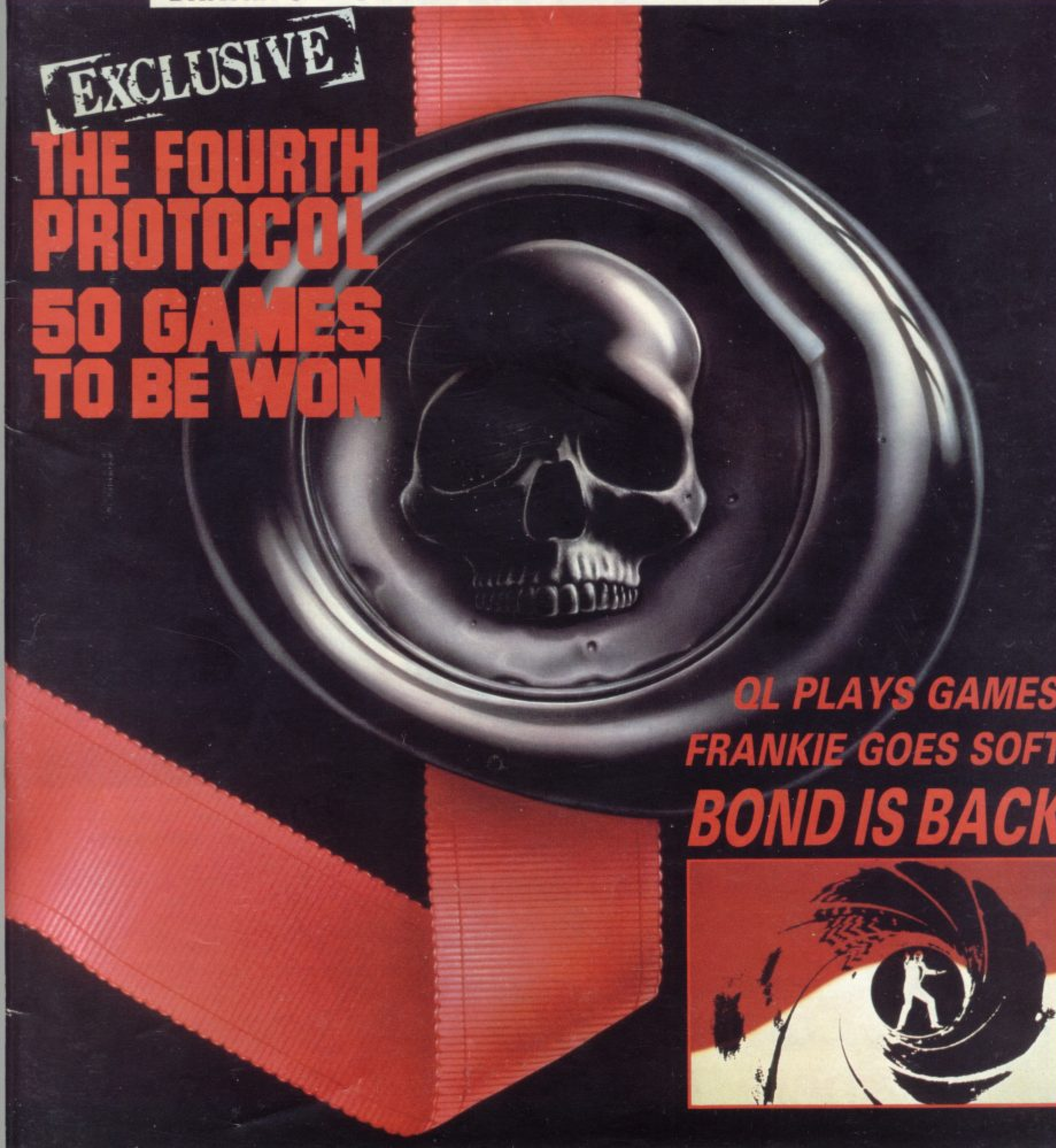
July 1985 No. 40

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BRITAIN'S BEST SELLING SINCLAIR MAGAZINE



EXCLUSIVE

THE FOURTH PROTOCOL

50 GAMES TO BE WON

QL PLAYS GAMES

FRANKIE GOES SOFT

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SOFTWARE



On Her Majesty's Secret Software, page 20

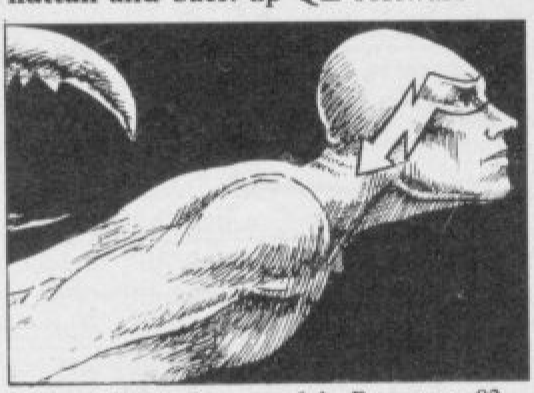


Frankie goes to Liverpool, page 58

HARDWARE

PROGRAMMING

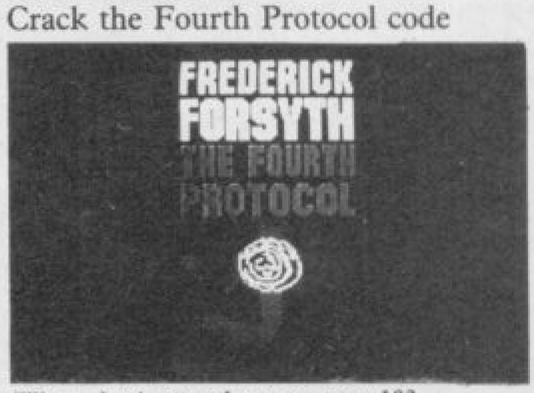
LISTINGS



Electro-Man in Revenge of the Bugs, page 82

FEATURES

REGULARS



Win a classic spy adventure, page 103

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ABC 91,901 Jun-Dec 1984

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SU7

The year of the Tiger

THE SOFTWARE market is reeling from the collapse of Tiger, one of the major distributors, with debts of up to half a million pounds.

Tiger was the exclusive distributor for the John Menzies chain, and matters came to a head when Menzies returned large quantities of unsold stock, bought on a 'sale or return' basis.

Tiger seems to feel it was badly let down, claiming Menzies had promised to support Tiger in its time of crisis.

Bill Jones, merchandise director for Menzies, says such criticism is totally unjustified. "There is one hell of a lot of software involved," he says, "in excess of £100,000 worth. An awful lot of Tiger's problems they brought on themselves. We did everything in our power to ensure their survival — to a limit."

The word on the street suggests up to a dozen major software companies might be forced to close because of the money they are owed by Tiger.

At least 160 software houses are owed money by Tiger, although only two or three are owed more than £20,000. Brian Wilcox of Elite, owed £19,000, says Elite is expecting to be recompensed by Menzies.

Because much software goes out of fashion very swiftly, the returned stock, worth more than £400,000 at retail prices, is unlikely to fetch more than £25,000 in the trade. That could lead to a glut of dirt cheap software on the market.

Major creditors of Tiger include Ocean, Firebird, Elite, Hewson Consultants and Argus Press Software, among others. Some companies, however, were clever enough to see trouble coming, and got out quick.

Clive loses control

THE COLLAPSE of the Sinclair empire may be on the way according to industry watchers and financial pundits.

Sinclair Research has had to deal with a £5 million bank overdraft and debts totalling £10 million to pay off creditors Thorn EMI and Timex.

Sir Clive is looking for new investors who could save the company. Thorn EMI was quick to deny that it would take a stake in the company and write off its debts owed for its products.

Other candidates for a rescue plan include Philips, Pye and the British electronics giant GEC.

Sinclair's financial problems are the result of a general depression in the computer industry. A drop in demand for the Spectrum Plus and the halt in production of the over-stocked QL has meant that staff at the Timex manufacturing plant at Dundee have been put on a two day week.

A statement put out by the company shows that Sir Clive is also having to restructure Sinclair management. "Sir Clive has been seeking a new chief executive officer for the company, a post which he has held to date." The statement goes on to say that despite the new top level vacancies Sir Clive would continue as chairman.



Clive: looking for money

If the crunch comes, Sir Clive would be faced with two options. He could sell part of his remaining 90 percent company stock or, alternatively, he could sell Sinclair technology.

Depsite financial difficulties Sinclair still has the 40 percent lion's share of the computer market, though that market is diminishing. Sir Clive's problems are not on the scale of the financial disaster which caused the Acorn-Olivetti merger earlier this year. Acorn is now having problems with the new BBC Model B+ which retailers are refusing to take.

Commodore is also likely to be in dire financial straits by the end of the year. Irving Gould, recently appointed chairman of Commodore, has warned creditors that it is likely to make a $20 million loss.

Atari is having distribution problems with its new range of computers. It has dropped links with Terry Blood and Lightning.

Midsummer Microfair

NEW DISC systems and interfaces, discounts and a great summer sale are all under one roof at the 16th ZX Microfair, to be held on June 22.

The venue is the new Horticultural Hall at the junction of Greycoat Street and Elverton Street, London SW1 – a short walk from Victoria station.



Johnston: 16th show

The show will be open from 10am to 6pm and the price of admission is £1.50 for adults and £1.00 for those under 14 years. Advance tickets are £1.25 for adults and 80 pence for under 14s. Send a cheque, made payable to ZX Microfair, and an SAE to Mike Johnston (organiser), Dept SU, ZX Microfairs, 71 Park Lane, London N17 0HG.

Death of ZX-81

SOFTWARE FARM, the ZX-81 software specialist, may be forced to pull out of that market following the demise of distributor Tiger.

Tiger was the only distributor prepared to take ZX-81 software in any quantity.

"It's rather a disastrous stroke for us," says director Julian Chappell. "We cannot turn a profit on ZX-81 software by mail-order only, and it does leave a very big question mark on the future."

Although Tiger owes Software Farm over £5,000, Chappell is adamant that the company will not fold. "We're moving into the Spectrum market anyway," he says. "We'll probably continue to sell our ZX-81 software through our software club".

The first Spectrum game from Software Farm is planned for the end of July. **Potty**



Chappell in happier times

Professor will be based on the wacky machines drawn by Heath Robinson.

more news on page 6

128K Spectrum mystery

THE SINCLAIR silly season seems to have arrived early with rumours of a new 128K Spectrum.

A story in *Popular Computing Weekly* started the controversy and since then software houses and press alike have been trying to find the truth behind the rumours. One top software house confirms that it has heard about the new model from Sinclair: "We have not got one yet but we are on the list. We expect it to be delivered just before Christmas."

The new machine will be Z80 based and will have to incorporate a way of switching 64K or 16K blocks of RAM as the eight-bit chip cannot address 128K.

The software house also says: "We already have a method of switching in the extra banks of RAM and we have some plans already for the new machine."

Sinclair Research would not comment on the Spectrum 128K but Julian Goldsmith, a spokesman, says: "We obviously have people down at Metalab who are looking into new applications. We have always portrayed the Spectrum machines as being a family of machines and if we see the need we may add to it."

Many software houses, however, have not been told about the new computer. Margaret Austin of the adventure company Level Nine says: "We have only seen press reports. Nobody had talked to us about supplying one. It would be nice though. Few manufacturers give software houses development machines."

John Campbell of Campbell Systems says that he also has not heard about the new machine. He has, however, discovered other projects: "I have heard from Sinclair that they might release a new Interface 1."

The interface would have an inbuilt microdrive and be priced at £50. The price is half that of the current Interface 1 Expansion system and would be equivalent to buying one microdrive and getting the RS232C free.

As Prism dies Blood mops up

TERRY BLOOD is now the only distributor of Sinclair hardware in the country, following the final liquidation of Prism Technology with total debts of £7.5 million. Terry Blood is also helping to deal with returned Spectrums from Prism customers.

"We are really just acting as a postbox for Sinclair in this matter," said a spokesperson. The largest retail outlets such as Smiths and Boots deal directly with Sinclair Research, but others will now have to buy through Terry Blood.

Sales of the Spectrum Plus are now said to be running at 7,000 a week, and the QL at about 500 a week, which is described as an improvement. "We have been evaluating dealers and appointing a network of 500," said the spokesperson. "It's selling on home computer profit margins which means retailers have to do a lot more work. But the returns are very low."



New releases

CONTINUE the adventures of **Jet Set Willy** in a new setting involving aliens, more puzzles and more rooms. **Jet Set Willy II, The Final Frontier** from Software Projects is in the shops now at £6.95.

Popeye and **Hagar the Horrible** are two games to look forward to from DK'tronics. Feed Popeye spinach to keep his strength up in his search for gifts to win Olive Oyl's love. Popeye will be released in July. **Hagar the Horrible** is to be released in the autumn, and is based on the popular cartoon strip.

A host of releases can be expected from US Gold in the next few months, all for £7.95. **Dambusters** is a historical representation of the raid on the German dams in World War 2. It will be available in July. **Buck Rogers,** based on the film is out this month.

Frank Bruno's boxing, endorsed by the man with fists like sledge hammers, is Elite's latest offering and is a boxing simulation based on Nintendo's arcade game **Punch Out!!** You control Bruno, who is transparent so that you can see your opponent through him. Costing £6.95, it will be available in mid-July.

Also from Elite, **Scooby Doo,** with theme and graphics based on the TV cartoon, will be ready in early September at £6.95.

Load up for **Highway Encounter,** Vortex's new game which is a fast shoot 'em up played on a highway overrun by hostile aliens. To be released on July 14, it is priced at £7.95.

Neverending Story is a new release from Ocean, based on the film of the same name, and is due at the end of August.

The newly resurrected Imagine label has signed up Konami's arcade games for release on the Spectrum, all priced at £7.95. **Hypersports,** reviewed in this issue, was released in June and **Konami's Tennis** follows in July. **Yie Ar Kung Fu, Hyper Rally,** and **Konami's Golf** will follow.

Two long-awaited games from Digital Integration are imminent. **Tomahawk** and **TT Racer** will be released sometime in the autumn and the price will be under £10.00. **Tomahawk** is a helicopter flight simulation based on the Apache. It features 2,000 ground scenes and 3D graphics.

TT Racer is a racing simulation based on the Suzuki Project 500. As you lean to accelerate round a corner the picture tilts giving a more realistic effect.

Another simulation is **Jump Jet** from Anirog. It simulates vertical take-off aircraft. It will be in the shops on 22 July at £7.95.

Three Days in Carpathia comes from Ariolasoft but was written by the Ram Jam team who programmed **Valkyrie 17.** Ariolasoft is giving nothing away, but we do know that it will be an adventure of sorts. It is due to be released this side of Christmas!

Nodes of Yesod, from Odin, features a somersaulting spaceman. It is an arcade adventure where you have to search for objects in a maze. It should be available in mid-June and costs £9.95.

On the Run will be out at the end of this month costing £6.90, from Design Design. You are an intrepid explorer trapped in a large maze — around 250 screens.

Finally, from Melbourne House comes **The Way of the Exploding Fist** in July for £8.95. It is a karate game incorporating 18 kicks, blocks and jumps and is similar to the arcade **Karate Champ.**

more news on page 8

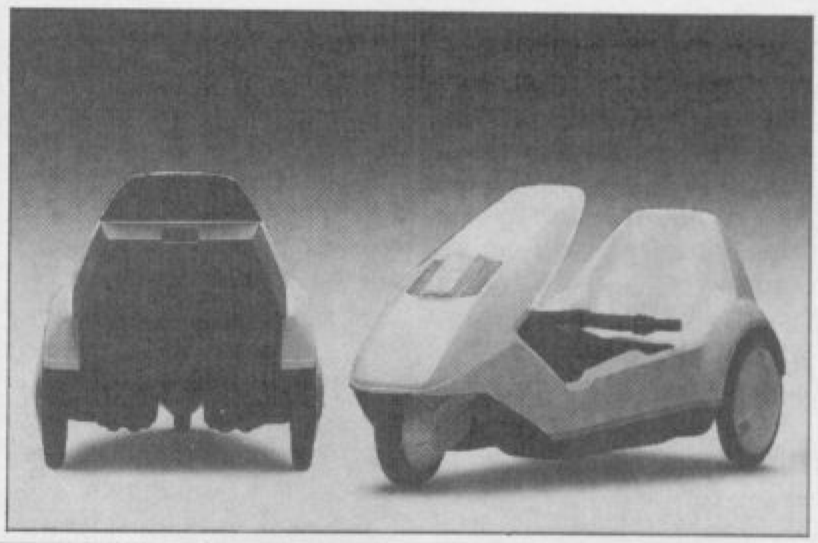
GALLUP TOP 30

This chart is compiled by Gallup by sampling sales at 250 retail outlets, including high street chain stores and independent home computer shops

MONTH ENDING MAY 16

1	SOFT AID	QUICKSILVA/VARIOUS
2	SPY HUNTER	US GOLD
3	WORLD SERIES BASEBALL	IMAGINE
4	STARION	MELBOURNE HOUSE
5	SHADOWFIRE	BEYOND
6	BRUCE LEE	US GOLD
7	GYRON	FIREBIRD
8	CHUCKIE EGG 2	A'N'F SOFTWARE
9	FINDERS KEEPERS	MASTERTRONIC
10	EVERYONE'S A WALLY	MIKRO-GEN
11	GRAND NATIONAL	ELITE
12	DEATH STAR INTERCEPTOR	SYSTEM 3
13	ALIEN 8	ULTIMATE
14	RAID OVER MOSCOW	US GOLD
15	GREMLINS	ADVENTURE INTERNATIONAL
16	MOON CRESTA	INCENTIVE
17	BRIAN JACK'S CHALLENGE	MARTECH
18	FORMULA 1 SIMULATOR	MASTERTRONIC
19	DRAGON TORC	HEWSON CONSULTANTS
20	MATCH DAY	OCEAN
21	BOOTY	FIREBIRD
22	DALEY THOMPSON'S DECATHLON	OCEAN
23	GHOSTBUSTERS	ACTIVISION
24	CHILLER	MASTERTRONIC
25	AIR WOLF	ELITE
26	FOOTBALL MANAGER	ADDICTIVE
27	WIZARD'S LAIR	BUBBLE BUS
28	911 TS	ELITE
29	COMBAT LYNX	DURRELL
30	SKOOL DAZE	MICROSPHERE

C5 is dropped



THE C5 has been dropped from the catalogue of distributor Lightning, due to disappointing sales and an ill-informed media onslaught.

Spokesman Dave Woods says it proved impossible to sustain the initial interest in the machine and Lightning therefore decided not to place further orders.

Sinclair Vehicles spokesman Bill Nichols says the decision is regrettable but the number of C5s involved is not significant. "Sales up until April were 8,000 and there has been an upturn with the better weather," he says.

On the subject of bad press, Nichols says the machine was taken far too seriously at first. "An expectation was aroused, and perhaps we should have told the world more about it beforehand."

The *Observer* recently published a story alleging that Sinclair Vehicles was up for sale. "Several parties are understood to have been approached," it stated. According to Nichols, the story was, "not true at all. There have been and are no plans to sell Sinclair Vehicles."

Faster than a speeding bullet

IS IT A BIRD? Is it a plane? No, it's yet another software spinoff, this time featuring the guy who wears his pants outside his trousers.

Beyond, who has first refusal on all games from American software house First Star, has jumped at the offer of **Superman** which will be released on its new label, Monolith.

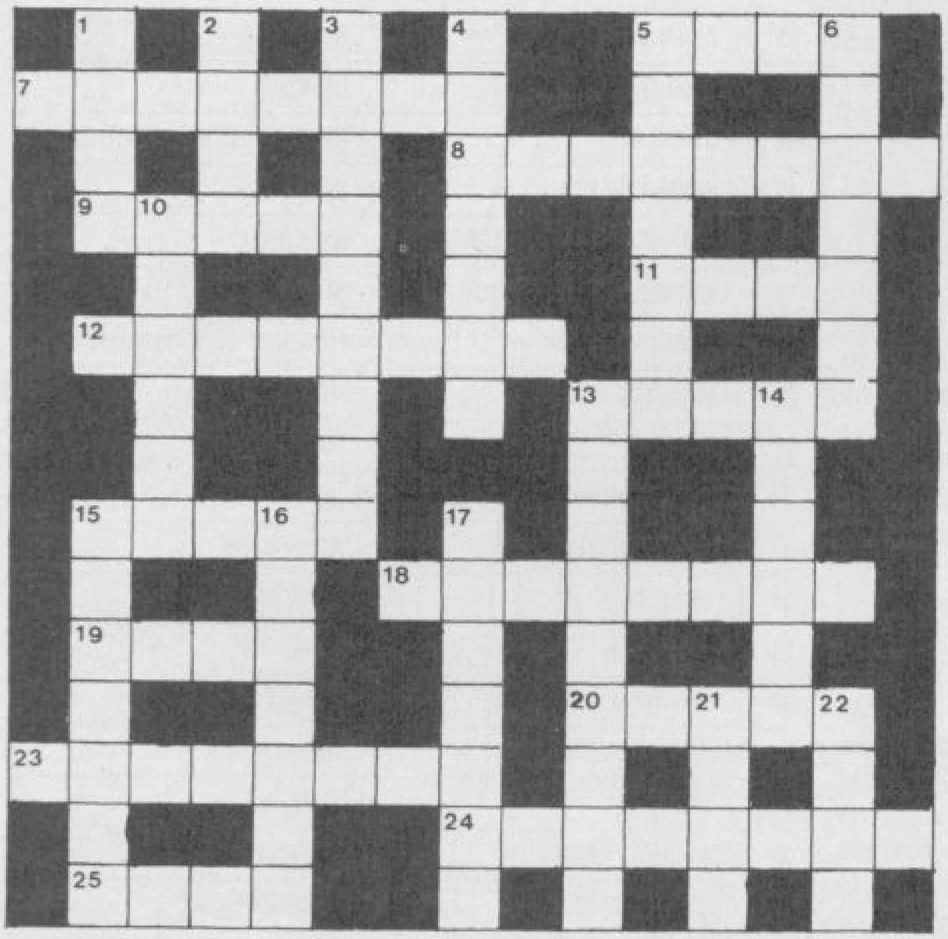
Superman, which should be available in the autumn, will be as faithful to the comic strip as possible, featuring cartoon-style graphics. Clive Bailey of Monolith says, "Every stage of the game has to be approved by DC Comics in the USA."

The game is written using an authoring system — much faster than conventional methods of programming. The games designer, graphics artist and musician can all work on the game together.

The deal means that games based on other characters from DC Comics, like Batman and Supergirl, may be forthcoming.

According to Clive Bailey, Monolith hopes to release the Spectrum and Commodore versions at the same time. The price of the Spectrum version will be around £9.95.

ZXWORD by Henry Howarth



Across

5. Exchange for wasp (4)
7. Modem perhaps unwelcome when called in (8)
8. Aixelsyd (8)
9. Following string in the rafters (5)
11. Musical ending of a programmer, by the sound of it (4)
12. Not a logic gate (8)
13. Points to attempt for access (5)
15. Somehow cater for debugging (5)
18. Albino MI expansion? (8)
19. Space for nothing in ROM (4)
20. Stored LED, if corrupted (5)
23. Heaven for Nordic gods (8)
24. Royal Exchange with up-market boat to put on the market again (8)
25. Some absurdly irrational number (4)

Down

1. A million ruined the game (4)
2. For it must follow in Basic (4)
3. Replace stored information above pen (9)
4. Commanded a pair like (x,y) (7)
5. SI unit of Information Technology? (7)
6. Type of number encountered at junior school (7)
10. Input digit for key-strokes? (6)
13. EOF as office wastebin, perhaps (3,2,4)
14. Spin to tear (6)
15. Strings as substring of both read statements? (7)
16. Imperative statement (7)
17. Where to browse to get your routines? (7)
21. Large in amplitude (4)
22. Cut into little bits what are unfair when loaded (4)

solution on page 110

Putting zap into the QL

WHAT IS claimed to be the first arcade game launched for the QL is **Zapper** from Eidersoft.

Ken Browning, company head, describes it as 'nothing new' but adds that it contains 'super-smooth sprite graphics and looks a bit like **Galaxians**'.

The game was written by Janko Mrfic-Flogel, a 16-year-old Yugoslavian who is still at school. He has managed to squeeze 11 levels, with 18 aliens on screen at the same time, onto the QL.

Janko is also the author of **QL Caverns**, an arcade platform game from Sinclair Research. The game contains 50 locations and uses levels and ladders in a similar way to **Jet Set Willy**.

A new company called Westway is also getting into the act with an arcade game called **EVA**.

The game bears similarities to **Jet Pac** but involves building a matter transporter while dodging energy bolts. Both **QL Caverns** and **EVA** are reviewed in QL Software Scene.

All aboard for Exchange

THE ROM-based version of the Psion application software should be available by the middle of the year.

The package, called Exchange, will include integrated versions of **Abacus, Archive, Easel** and **Quill**. It will plug into the memory expansion bus at the side of the computer and not into the ROM slot at the back.

Sinclair has yet to decide whether to produce a new version of the QL incorporating Exchange onboard. Such a move would depend on how well the add-on ROM was received.

A halt in production

A HALT to QL production was called recently because output had exceeded demand.

Julian Goldsmith, a spokesman for Sinclair Research, confirms that production is at a standstill but says that 'the measure is only short-term'.

Previously, Sir Clive Sinclair had been predicting that 200,000 QLs would be sold this year but generous estimates have put the total sold at 60,000 covering the period since it was launched.

The company is now looking for sales abroad and has converted much of its English stockpile for foreign markets, two of which are



Searle: not worried by lack of success

Spain and the United States. Goldsmith says: "Spain is a big market and we have a 75 percent share of it."

The introduction of the QL into the States has also provoked a lot of interest. The company says that it has recieved over 26,000 enquiries about the QL and that the machine should have a strong future in the States. Former Sinclair managing director Nigel Searle is co-ordinating the marketing operation.

Searle is eminently qualified to spearhead the attack on the US. He has had eight years experience of the American way of life and three of those where spent as managing director of Sinclair US in Boston.

He is not worried by the relative lack of success so far encountered by the company. He said, at a meeting of manufacturers and distributors before he left Britain, that before they had joined Timex they had sold almost 25,000 computers on the American market. The company was optimistic that it could sell at least 50,000 machines this year.

Intelligent Sketchpad

A COMPREHENSIVE graphic design package has been launched by Sigma Research.

Sketchpad is software-based and can be obtained on microdrive. It is similar to the Talent **GraphiQL** but does not allow the creation and manipulation of graphic textures. The package does, however, allow the usual pixel, line, arc, fill, and text functions.

Sigma Research claims that one of the most advanced features of **Sketchpad** is its ability to store displays in a compact data file which only contains those sections of the screen which have been used for drawing. That makes the package faster to load than others on the market.

More information about Sketchpad can be obtained from Sigma Research, 231 Coldhams Lane, Cambridge, CB1 3HY.

Quest for brain games

HARDWARE manufacturer Quest has entered the games and utility market.

The releases include a card game, an adventure and a sprite designer. In **Blackjack** the computer plays the part of the banker with three randomly generated packs of cards. Full colour graphics are used and the company claims that every permutation of the casino game is possible.

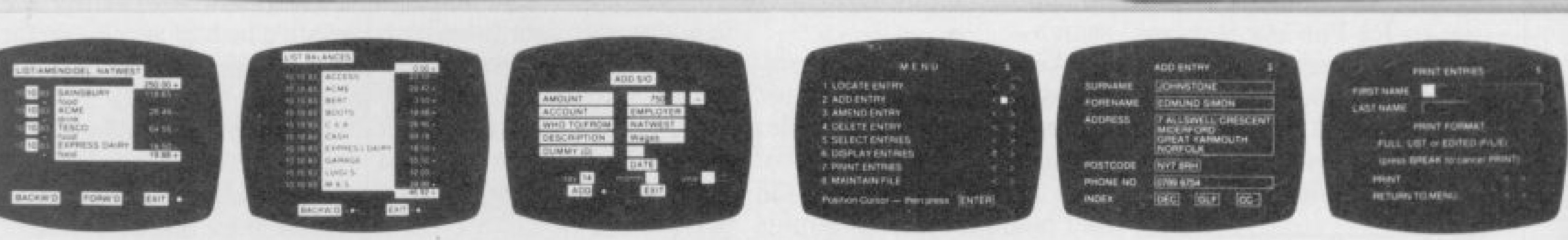
Quest – The Adventure was originally a game for the Apricot PC. The company has transferred it to the QL and says that the colour and graphics have been enhanced on the new version. The game involves navigating a sailing ship around an uncharted ocean, collecting treasure and keeping the morale of the crew high.

The sprite designer, **Zappit**, allows the user to develop up to 99 sprites which can be on the screen at the same time and manipulated through SuperBasic, without the use of PEEK or POKE.

All the packages are available on microdrive but Quest intends to produce disc versions in the near future. **Blackjack** is priced at £19.95. **Quest – The Adventure** and **Zappit** cost £14.95. More information about all Quest products can be obtained from PO Box 49, Torquay, Devon.

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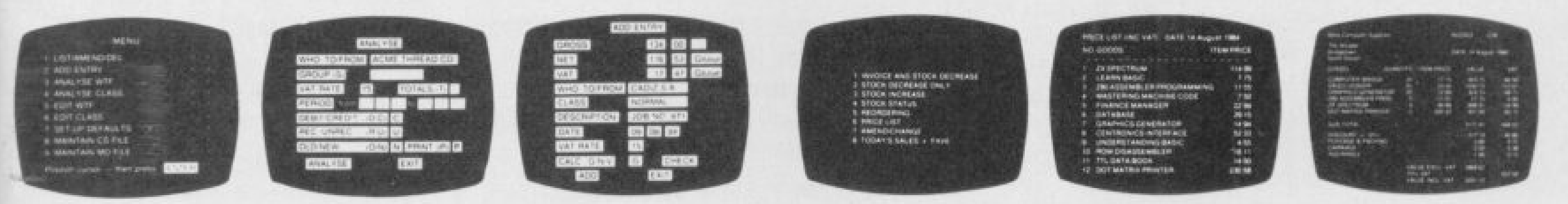
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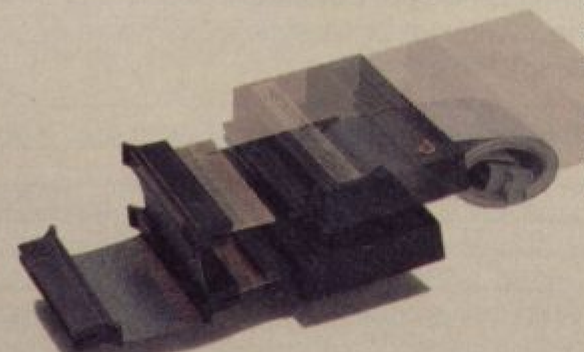
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SU

Rating system causes comment

WHERE is our friend Gilbert? Has he retired? Has he been sacked? Then work out a Chris or even Clare factor.

Without Gilbert, when I want to buy a game, I must go through every *Sinclair User* I own, searching for a review. Previously I could safely buy a game sure it was worth what I spent on it.

Please return that amazing game directory in the back of our trusty *Sinclair User*, I beg of you.

Steve Griffin, Harrogate, North Yorkshire.

● *Never fear. An updated Software Directory will be returning as soon as we have space for it.*

I AM glad to see that your games ratings have changed. I thought the Gilbert factor was totally unreliable. I cannot understand why **Technician Ted** only got seven, while **Horace goes Skiing**, a totally boring game with no variation, got an eight.

David Gee, Chesterfield, Derbyshire.

Contempt for letters pirate

I AM WRITING to voice my thoughts on the piracy of articles. The offender is Daniel Rose, of Tonbridge, Kent, who had a letter published in Zap Chat — *Sinclair User*, June — giving infinite lives for **Alien 8.**

The pokes, and the complex machine code program were lifted from the May issue of *Your Spectrum*.

Daniel Rose has opened himself up, not to the acclaim of the readership of *Sinclair User*, but rather to their contempt for stealing the article.

I hope you're listening, Daniel Mud! And to anyone who has discovered something of interest, send it for publication. There are enough ideas to support the computing press, without the need for recycling.

Malcolm Paknadel, Cambridge.

Games playing only a trend?

GAMES are an aspect of home computing but don't let the tail wag the dog.

Games playing among my acquaintances tends to be short-lived, they either become interested in developing their computer knowledge or they lose their interest in computers.

Games may be selling computer mags at the moment but don't forget tastes can be volatile.

John Taylor, Grantham, Lincolnshire.

History is lost in space

GALACTIC warfare interspersed with a smattering of history — that was my impression when I read your review of **Starion** — June *Sinclair User*.

What history there may or may not be in the game I shall never know.

I would like to advise your readers that unless you have the razor sharp reactions of a Wild Bill Hickock, **Starion** is a rip-off, and its historical element will remain a closed book for ever.

J W Ewart, Leasingham, Lincolnshire.

A plea for missing issues

A FEW months ago I got the urge to complete my collection of *Sinclair User*. I've gathered that issues one to eight are not available.

I am wondering if someone out there would like to sell those back numbers.

E van Wouwe, Frans de Ceusterlei, 60, B2120 Schoten, Belgium.

Captured in record time

I BOUGHT **Shadowfire** on May 14 and completed it in two hours and 10 minutes.

The only way you can complete it is by killing and capturing all 43 people on the ship.

I have just read June's *Sinclair User* and your review said it was hard!

P M Davies, Cumla Neath, West Glamorgan.

Learning game nukes schools

FURTHER to your review of **Worldwise: Nuclear Weapons** in the June issue of *Sinclair User*, might I point out that Worldwise can be purchased from us at the Richardson Institute for Conflict and Peace Research, Lancaster University. **Dr Paul Smoker, University of Lancaster, Lancaster LA1 4YF.**

I REALISE there is concern over program piracy using school equipment, but surely the implied threat in your **Worldwise: Nuclear Weapons** review is taking things too far: "a study of nuclear weapons around the world aimed at secondary schools." **Ian Rhodes, Dukinfield, Cheshire.**

Quill cheats on adventures

IF YOU save your position in a Quilled adventure and then load it into another Quilled adventure, when asked 'what next?' you jump to a position near the end of the game with a score of 70 or 80 percent.

Clive Parsons, Newquay, Cornwall.



Cover-up job on Arthur

I HAD to laugh when I read A Wilson's letter in the June issue about your covers.

Just 10 minutes earlier I had stood in my newsagents desperately trying to conceal the front cover picture of Arthur Daley!

Christopher Robinson, County Durham.

Outrage over complex game

LAST NIGHT I spent three hours addicted to **Komplex.** I bought *Sinclair User* this morning — great, **Komplex** reviewed! Where's the Classic sign? Two stars?

Come off it, this game is fabulously addictive — it's the best game I have. You say the graphics are 'basic & wireframe', those on **Starion** 'superb 3D', but they are both similar effects.

A *Crash* reader, (Samuel Best-Shaw), Maidstone, Kent

● *Hah! A* Crash *reader — I might have guessed. Ed.*

Jack receives turkey award

I READ your magazine frequently and think the game reviews are excellent and the screen-shots are sharp and clear.

My turkeys of the month — **Ghostbusters** from Activision, **Road Racer** from Thorn EMI and **Jack and the Beanstalk** from Thor. **Jeremy Bye, Carlisle, Cumbria.**

Go for gold in Finders Keepers

I HAVE finally completed Mastertronic's excellent **Finders Keepers**. Here are a few tips for those readers who don't know which objects to combine:

Philosopher's stone + iron bar = gold bar; pile of mud + spark of life = mud monster; empty bottle + model of Cutty Sark = ship in a bottle; broken sword + blacksmith = Excalibur.

To escape from the castle past the puss without boots, drop the sulphur and the charcoal on the saltpetre to make gunpowder. Then drop the magic flame and poor old puss gets blown to pieces.

To gain infinite lives just MERGE "" and place POKE 34252,0 behind the RAND USR command.

I have also found a useful bug in **Beach Head**. When driving a tank on the beach, if you shoot an enemy installation a score is printed over it. If you are close enough you can shoot the score before it disappears.

Once shot the score will stay there and can be shot again and again to get extra points. The score acts as an object and your tank will be destroyed if you touch it.

Marc Kavanagh,
Cheshire.

Hungry spy is knocked for six

I CLAIM to be the **Spy Hunter** genius, I've scored 397,226 on my sixth game.

Lee Waters,
Chesterfield.

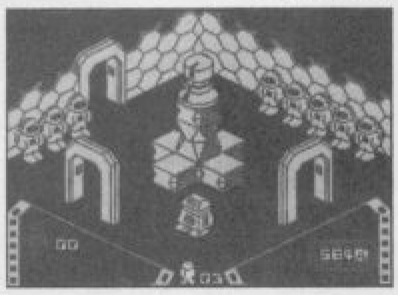
Alienation of Knight Lore

WE HAVE just completed Ultimate's **Alien 8**. We managed to crack the game in two hours, 53 minutes, 43.87 seconds.

We would also like to warn any would-be adventurers of the hopeless ending after successfully activating all 24 cryogenic chambers.

An almost identical game to **Alien 8** is **Knight Lore**. Anyone who owns either game would not be advised to spend £10 on the other.

Gordon Whyte and
Grant Fergusson,
Paisley,
Glasgow.



Beating the hell out of Styx

I HAVE reached a score of 1,318, 890 on **Styx**. I played the game for over one hour. When I turned the computer off, I still had over 40 lives left. Can anyone beat that?!

Dales Pearce,
Leeds

● *Amazing! To think some people are still playing* **Styx** *— can anyone beat that?*

The surprise from Styx

I HAVE got $24,000 on **Ghostbusters**; lapped round Dr Franky twice; rescued Esmerelda on **Hunchback**; beat the computer at **Match Day** in the cup final; blew up Moscow in **Raid over Moscow**, and hit all the targets in **Beach Head**, blowing up the big gun.

However, can anyone beat my score on **Styx**? I even surprised myself by scoring over half a million! The secret is, on the first phase, to get to the door on the right, but do not go down into the river. The spiders cannot kill you there, by the way. When I get there I turned it off with 38 lives left!

Paul Clark,
West Bridgford,
Nottingham.

● *Another blast from the past.*

The last key to backpacking

I HAVE BOUGHT Fantasy's arcade adventure **Backpacker's Guide to the Universe** and I'm having great difficulty.

The instructions say you need four keys to get through a gate but I have only found three and one of these is hidden behind a gate.

Can anybody give me some tips on how to complete the game?

Kevin Watts,
7 Palmer Drive,
Lakenheath,
Suffolk.

Wizard kill by Bruce Lee

I HAVE **Bruce Lee** from Ocean and I have completed it many times. My highest score is 1,017,700 and I have killed the wizard 38 times.

I claim to be an all round first class **Bruce Lee** professional player. I could have kept going but after four hours I aborted with 22 falls left — cop that then!

Neil McLoughlin,
Crawley,
Sussex.

Home team is on the ball

I CLAIM to be the world's best **World Series Baseball** player. I played a match of nine innings and won 117 to 1. I hit eight home runs, four consecutively. I made 15 catches.

When I had gone over 99 the scoreboard showed the score as :0. My final was :7 — in other words, 117.

World's best
baseball player,
St Helens, Merseyside.

High scorer is over the moon

RECENTLY I bought the game **Moon Cresta** by Incentive Software. I felt very pleased when I broke the 30,000 point barrier and gained access to the passwords. Immediately I sent off the entry from to enter the competition.

The entry form states that the prize will be an original arcade machine of **Moon Cresta** and that the winner will be announded on December 31. Your reviewer of **Moon Cresta** stated that the prize is a video recorder and that the prize will be awarded to the first person who gets 30,000. Have you got it wrong?

Mark Jakes,
Sandy, Bedfordshire.

● *We got it wrong. Humble apologies. Ed.*

Bloodaxe score has the edge

JUST A LINE to say that I completed **Brian Bloodaxe** on May 11. My high score is 147,407. I have sent proof of completion to The Edge.

Michael Devlin,
aged 12,
St Helens, Merseyside.

Taking the plunge

TO OBTAIN unlimited divers in **Fantastic Voyage** enter the following to load and run the game code:

```
10 CLEAR 30791: LOAD "VOYAGE" CODE: POKE 54492,167: BORDER 0: PRINT USR 53248
```

The game will still end if the main body overheats during infection.

S G Miles,
Wallasey, Merseyside.


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SINCLAIR USER Classics are programs which, in our biased and eccentric opinion, set new standards in software. They are the programs by which the others should be measured. If you buy no other software, buy these. No self-respecting Sinclair user should be without them.

Software reviews carry a star rating, the basis of which will be value for money. Programming, graphics, speed, presentation, addictive qualities and the rest are taken into account.

Guide to ratings
★★★★★ 24 carat. Buy it
★★★★ Value for money
★★★ Nothing special
★★ Over-priced
★ A rip-off

EXCLUSIVE

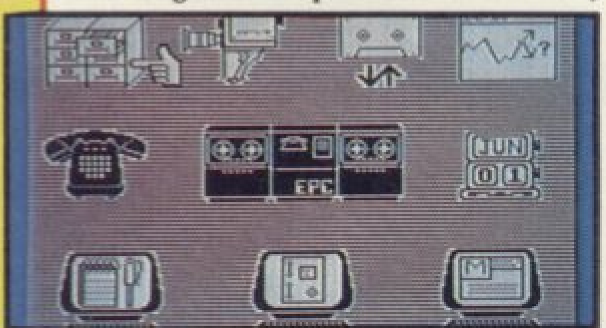
THE FOURTH PROTOCOL THE GAME

SINCLAIR USER CLASSIC

WARNING — possible breach of the Fourth Protocol . . .

As John Preston, and newly appointed head of C1(A) it is your job to look after military security and, ultimately, uncover a British traitor and a plan to destabilise a nation of the Western Alliance.

The game comprises three sections,



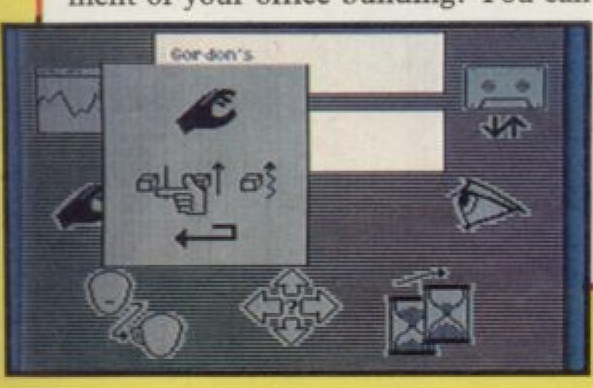
called The NATO Documents, The Bomb and The SAS Assault. In order to get into the last two you must use a code which is given to you in the previous section.

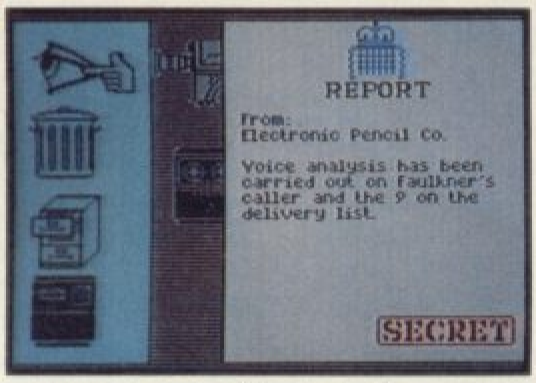
You begin in your office, reading memos sent by your superiors, using the phone, despatching watchers to tail suspects and receiving reports on the movements of potential traitors.

The game is controlled using a series of innovative and visually attractive icon screens. All input is made by moving a pointing finger to one of the icons and pressing ENTER.

Three terminals at the bottom of the screen provide contact with the outside world. The one on the left is used to read reports from watchers, the middle one gives you access to your reports and the one on the right allows you to read your memos.

File access is gained through the CenCom computer located in the basement of your office building. You can

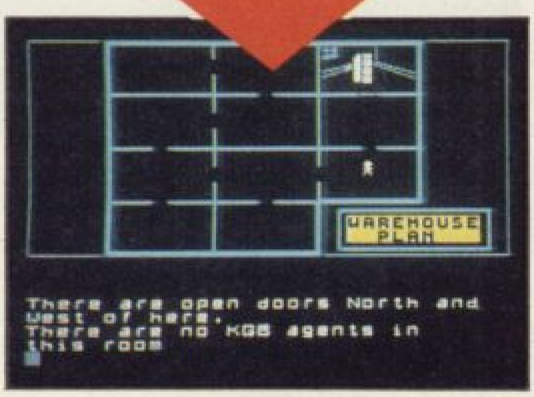




put your own files on the system or run checks and voiceprints on characters.

Files not held on CenCom can be accessed by ringing Blenheim and entering the correct code.

Once you have the file code the second section of the game can be

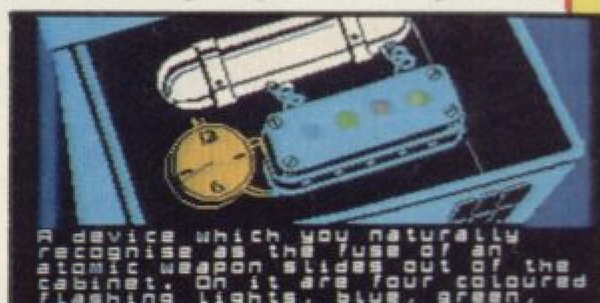


loaded. The Bomb covers a trip around the building picking up useful objects for your search across Britain to find the nuclear device.

The building has four floors, connected by lifts. Although icon-driven, the options are flexible enough to allow characters to talk to you and for you to move easily and quickly.

Once you have located the bomb you can access the third and undoubtedly the weakest part of the game, The SAS Assault. You must arm your squad and place them around the building using a schematic plan. In this sequence you use simple verb/noun sentences with a list of words available on request.

Having blasted your way to the room containing the bomb, you have only seconds in which to defuse it, all the while fighting off KGB guards.



Two seemingly irrelevant bits of information, chanced upon earlier in the game, are necessary to successfully render the device harmless.

The Fourth Protocol is the work of the Electric Pencil team and that is shown in the professional polish of the game. The icon graphics are excellent and the speed is incredible.

Although some icon actions, such as those used for movement, can take longer than traditional adventure text input, their use generates a high tech atmosphere in keeping with the game.

It is one of the most enjoyable, complex but easy to operate games which I have played in a long time. Even if you do not like the Frederick Forsyth's book you will, nevertheless, like the software. *John Gilbert*

Publisher Century/Hutchinson
Price £12.95 **Memory** 48K
★★★★★

more software on page 18



EXCLUSIVE

GLASS

COME HERE glassy-eyed Earthling. Do you want a job working for the Game Lords?

There are good job prospects for anyone entering the Game Lords' Alien Strike Simulator – **GLASS**. All you have to do is zap your way through hundreds of screens of 3D aliens and steer through chasms where coloured pillars block your way. All that action is interspersed with the relatively easy job of shooting radar antennae from a variety of alien space ships.



You have only four power shields and energy for those is used up quickly. Not to worry, the simulator provides an option which allows re-entry when all your shields have collapsed. You will be at the same level but your score will be re-set to zero.

Once past the hundreds of many-legged or robotic aliens, the killer tanks which rise and retreat over the horizon lobbing fireballs, and the corridors of columns, you will get a glimpse of one of the alien cities. It is a non-participant scenario but you have the satisfaction of watching the city being very untastefully nuked. The



effect is stunning as every pixel of the city explodes off the screen. Watch carefully as you will not see this again for another couple of hundred screens.

GLASS has stunning 3D effects and is value for money both in terms of quality and quantity of special effects and aliens. Add it to your library of games if you are an arcade fanatic. It takes a lot of beating.

John Gilbert

Publisher Quicksilva **Price** £7.99
Joystick Kempston, Sinclair
Memory 48K
★★★★

EXCLUSIVE

Hypersports

GET INTO training, sports fans, for a compilation of sporting simulations from Imagine '84.

Hypersports is licensed from the Japanese amusement arcade game of the same name, and should not be confused with **Daley Thompson's Supertest**, about to be released by sister company Ocean. On the other hand, it does the same sort of thing, and will test your biceps to the utmost as you pump the joystick in agony.

Swim two lengths of the pool, remembering to breathe. The graphics on this event are the poorest of the six. There are three other swimmers, and the end of the pool moves towards the swimmers, rather than the swimmers moving at different speeds.

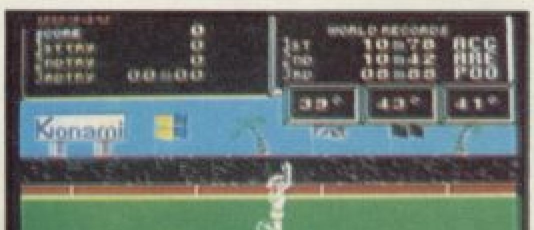
The game gets its feet on firmer ground with the clay pigeon shooting. The twin sights move up automatically, and you must time your shots to hit



the clay pigeons, or skeets.

The vault has the athlete trying to somersault as far as he can from a gymnasium horse, and an archery contest involves shooting at a moving target, taking wind and elevation into account.

The triple jump will be familiar to Decathlon players as a more complex version of the long jump, but the real killer is the weightlifting. An hilariously musclebound, moustached



klutz creaks and groans in his efforts to raise the dumb-bell, and you must choose the weight at which you want to compete. This is the event which really taxes your joystick wrist, and risks terminal damage to the keyboard.

The graphics are more varied and generally better than **Daley Thompson's Decathlon**, with much more humour. You play through the sequence until you fail to qualify three times, and each new round raises the qualifying level. There are tables for the three best results at each event, and the game certainly presents a



challenging experience.

Hypersports is almost assured of success in the shops, but whether it is better than **Daley Thompson's Decathlon** is another matter. The programming is certainly of similar excellence, except for the swimming event, but the sports themselves do not form a coherent sequence, in the way that the 10 decathlon sports do.

It is certainly superior to the current crop of sports simulations, and it will be interesting to see how it stacks up against **Daley Thompson's Supertest**, shortly to come.

Chris Bourne

Publisher Imagine **Price** £7.95
Joystick Sinclair, Kempston, Cursor
Memory 48K
★★★★



Frankie Goes to Hollywood

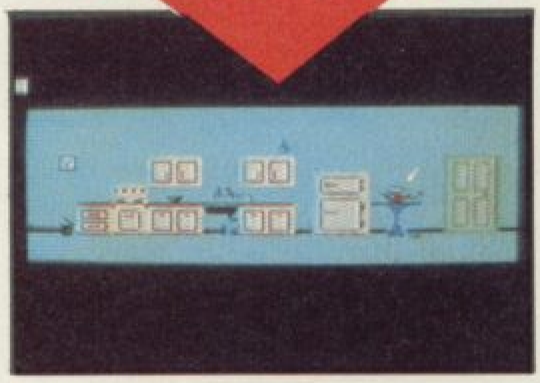
A SHADOW stalks the cloned terraces of monotonous streets. You are that shadow. You will remain a shadow unless you reach the Pleasure Dome, the world within the world within the world in which you live.

Who can take you to the Pleasure Dome? Frankie can. Move your shadow through the screens of kitchens, lounges, dereliction and prissy suburban streets, collecting what may help. Floppy disks open worlds of arcade fantasy where aircraft bomb Liverpool, where only you can save the lives of your friends. There's a murder to be solved; eight suspects — where's the clue? In a revolting pair of socks perhaps, but there are many entrances to the Pleasure Dome.

Screens explode with colour as windows open out onto new scenes — walk the shadow from behind and step into the frame, step into pleasure. Shoot Thatcher, watch Reagan and Gorbachev spit at each other. Once in the Dome you're no longer a shadow, but there's a dozen or more scenarios within the game, and four symbols to collect before you reach the centre.

Text intrudes slightly in the form of clues — 'the sea of holes is a sea of rooms' — triggered by the successful completion of problems. You must

SINCLAIR USER CLASSIC



recognise the alternative possibilities of ordinary objects — light switches, telephones, televisions — and experiment.

Faithful to the spirit of the band, if necessarily less outrageous, Frankie is a beautiful program, an adventure of great imagination, with some superb programming techniques in the use of expanding windows and icon-like objects to pick up and use. The screen shots shown here are from a pre-release version, but they give some



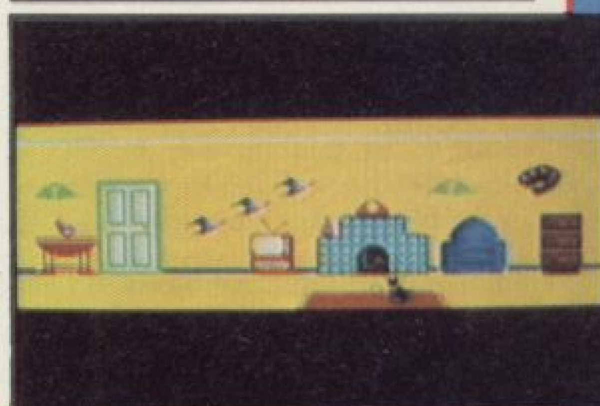
indication of the quality.

The game comes with a 15 minute live version of *Relax* supplied on a separate cassette, recorded in the States and previously unreleased. The reverse side of this tape features playing tips for the game, narrated by Patrick Allen.

Symbols × Shadow = Frankie Goes to Hollywood. Frankie × Spectrum = Buy it. *Chris Bourne*

Publisher Ocean **Price** £9.95
Memory 48K **Joystick** Sinclair Cursor Kempston
★★★★★





Give My Regards to Broad Street

IF LURKING around London underground stations is your idea of a fun time then **Give My Regards To Broad Street** ought to appeal.

Argus informs us that the game has been okayed by ageing ex-Beatle Paul McCartney, presumably because the plot of the game closely resembles the film. In other words, little happens and it's corny.



You are Paul, and if that doesn't put you off, you must travel around London by car trying to find the members of your band on the run. You must also pick up chords which have been lost from the hit song *No More Lonely Nights* – which still got into the charts despite my best efforts. You have 24 hours to find your crew.

With luck you will eventually learn to manoeuvre your temperamental vehicle and stop at a station as one of the characters is about to go in or come out. You must wait around until you pick one up, together with chords, but beware the wheel-clamping traffic wardens.

The game is technically excellent. There are two types of screen. The first display shows your car on the road map of London. Underground stations are highlighted and much effort has gone into producing a detailed map of the capital. There is also a radar screen at the bottom of the screen and information about characters who have just gone into or left stations.

The other screen depicts an underground station and shows you waiting for your friends. Every so often a warden comes along and you must rush back to the car.

It is unfortunate that such an obviously brilliant team of programmers did not have a better plot with which to work. Surely the film included more details than lost friends and musical notes. On second thoughts, perhaps not. *John Gilbert*

Publisher Argus **Price** £7.95
Joystick Kempston **Memory** 48K
★★★

more software on page 20

A View to a Kill

SILICON Valley is in danger of obliteration and 007 is sent to fulfil another improbable mission in Domark's **A View to a Kill**.

In order to destroy the chip industry, Max Zorin, mad genius, has planted a massive bomb in some disused mines beneath Silicon Valley. When it detonates, the San Andreas Fault will open up and tip the lot into the Pacific. Why not do something simple like poison the water?

There are three games, each played



in different locations and linked by code numbers.

You start in Paris. Just as you are about to be told the key to Zorin's plan, Mayday – played by Grace Jones in the film – takes a pot shot and kills your informant. A mad car chase follows. Mayday jumps from the Eiffel Tower and descends by parachute. You jump into a taxi and chase through the city to capture her.

The screen is split horizontally. The upper half is the 3D perspective view as seen through the windscreen and the lower half is an aerial view depicting road blocks, police cars and the



drifting parachutist.

Having captured Mayday, you load up in San Francisco for the next section set in the burning City Hall. Stacey, the obligatory blonde, is trapped in a lift and must be rescued. This section is an icon driven arcade adventure and is surprisingly easy to use.

A clue to Stacey's rescue can be found in the film, which is closely followed. There are around 75 rooms in the building, many holding objects vital for her rescue – a picture of the burning Hall is included showing your position in relation to the fire. The



graphics depicted in this review were taken from a pre-production copy of the game.

The final game places you deep within the mines. Mayday returns in this scene, though you may have to find her first. Only she can winch you down to the ticking bomb and winch you back with the detonator.

Objects litter the mine and can be used in the same manner as those in City Hall. The grappling hook is the first you will stumble across and is vital. Conveyor belts may be activated – but tread carefully.

You can play along to the original Bond theme tune, to Duran Duran's single of the same name or switch off for blessed quiet and a chance to hear Bond introduce himself: "My name is Bond, James Bond". *Clare Edgeley*

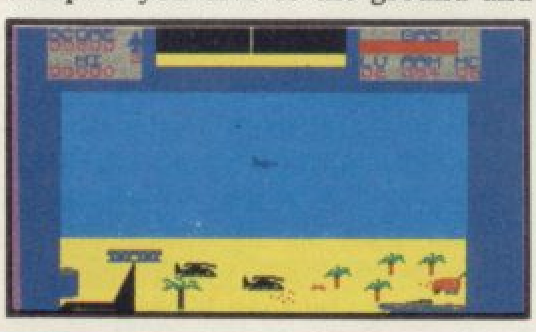
Publisher Domark **Price** £10.99
Memory 48K **Joystick** Sinclair Kempston, Cursor
★★★★

Falcon Patrol II

AS PILOT of a souped-up Hawker Jump Jet with the latest in ATG missiles you must blast the enemy helicopters out of the sky. Thrills. Once you have completed one sortie and destroyed a wave of 'copters, you move up a level of competence and take on another wave.

The enemy general is a complete imbecile as his pilots rarely fire at your VTOL jet and occasionally even have a go at each other.

The author has tried to add some realism to the game. If you are hit by shrapnel you dive to the ground and



explode. Also you must re-arm and take on fuel from platforms during your mission. One false move and you could crash.

Mediocre 3D graphics and blipish sound are compensated by the manoeuvrability of the aircraft and the ease of aiming the weapons. The game is nevertheless too easy. It's like shooting fish in a barrel. *John Gilbert*

Publisher Virgin Games **Price** £6.95
Memory 48K **Joystick** Kempston
★★★

Nicotine Nightmare

THIS GAME is sufficiently unplayable to send any non-smoker straight back to the pack. It is boring, slow and written in Basic.

The ultimate aim is to rid the world of cigarettes. Before stamping out the fag factory you have to prove your determination in a silly little test which is virtually impossible to complete.

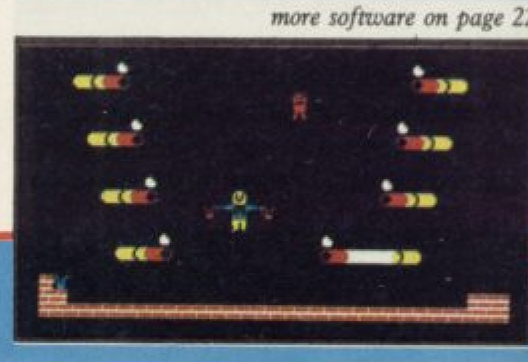
Extinguish six cigarettes out of 10 happily burning ones. Every time you pour water over a glowing tip a little demon creeps up to the sodden dog-end and relights it.

Perseverance finally pays off and the next task is to get into the factory. Dodge and jump rolling cigarettes and the irate shop steward, and turn off all the cigarette machines.

More could have been made of **Nicotine Nightmare**. The pace, graphics and feel of the game is about two years out of date. *Clare Edgeley*

Publisher Atlantis **Price** £2.99
Memory 48K **Joystick** Kemptson
★★

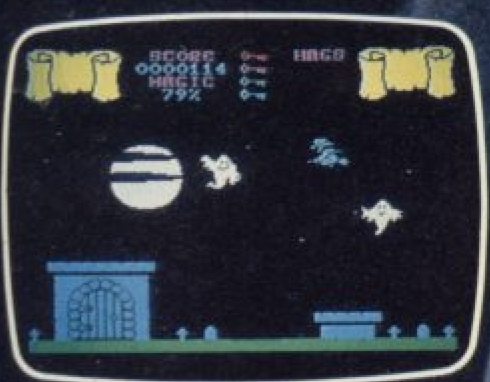
more software on page 22

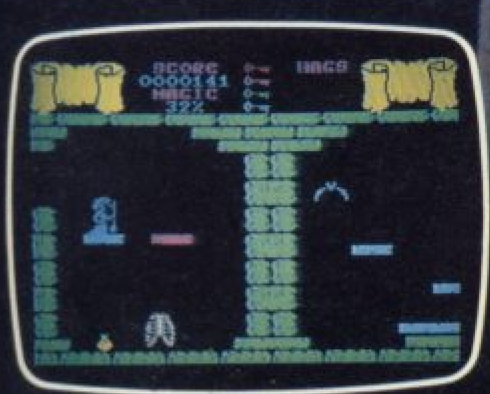


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CAULDRON









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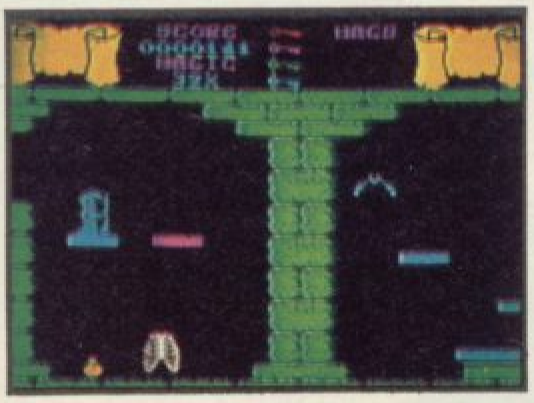
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Cauldron

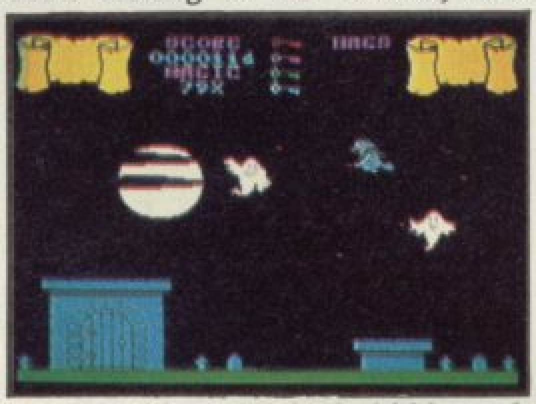
HEARKEN witches everywhere, play this game if you dare, defeat the Evil Pumpkin King to regain the broomstick from within.

In **Cauldron**, from Palace Software, the instructions are contained in eight rhyming verses which describe the basic scenario — it is up to you to figure out the puzzles.

The Evil Pumpkin has stolen the witch's golden broomstick and the only way it can be retrieved is to brew a spell which will gain her entrance to the Pumpkin's Lair. The spell's six ingredients are to be found in the rhyme and lie in the 64 caverns underground.



Above ground is variety of terrains — graveyards, woods, mountains, oceans and islands. There are four doors leading to the caverns, each opened with a cunningly hidden coloured key. Ghosts, killer seagulls and bats deplete your magical powers by hitting you.



You can fire at them though that also decreases your magic and the best tactic is avoidance. You have nine lives and each time you die you tumble off your broomstick in a spectacular fall.

Finding and picking up the spell's ingredients is no easy task. You may have to approch them in a roundabout way or find objects to place them in. Again, whole legions of nasties try to send you to the hereafter.



There are a number of teasers in this superb pictorial game with no clues offered in the instructions. Trial and error is the only way through it.

Cauldron has no sound other than the odd spectral beep, but the graphics are brilliant and colourful. Unfortunately, they flicker occasionally and the colours tend to merge. **Cauldron** is nevertheless a pleasing and playable game.

A bonus is to be found on the B side which contains the **Evil Dead**, never released for the Spectrum. You will be getting two excellent games for the price of one.

Clare Edgeley

Publisher Palace Software **Price** £7.99
Memory 48K **Joystick** Sinclair, Kempston
★★★★★

Lightmagic

THERE have been graphics designer programs before – notably **Melbourne Draw. Lightmagic** takes ease of use a step further and provides a comprehensive package for would-be screen designers.

The program can operate using a joystick or cursor keys. The menus are exceptionally clear and easy to toggle through. There are five modes.

Pen mode allows you to draw on screen as if you were using a pencil, with the added advantage of a rubber band feature for odd angles.

Circle and Fill commands are also available, although the Fill command can cause weird results due to the Spectrum attributes. To overcome that there is a Grid command which produces a grid of 8×8 squares on the screen, avoiding colour clashes.

In Brush mode there are 10 types of brushes which range from solid to airbrush; spectacular results can be obtained with these, especially as brush size can be altered.

Block mode can be used to move, mirror and rotate blocks of the screen and Text mode allows the addition of text. There is also a UDG designer which makes graphic designing easy.

As if all that were not enough, there is an enlargement feature. A section of the screen can be magnified four times – useful for fine tuning. Adding and changing colour is done by pressing X and choosing another colour.

The facilities offered are impressive and it can be recommended without reservations.

Theo Wood

Publisher New Generation
Memory 48K **Price** £14.95
★★★★

Helichopper

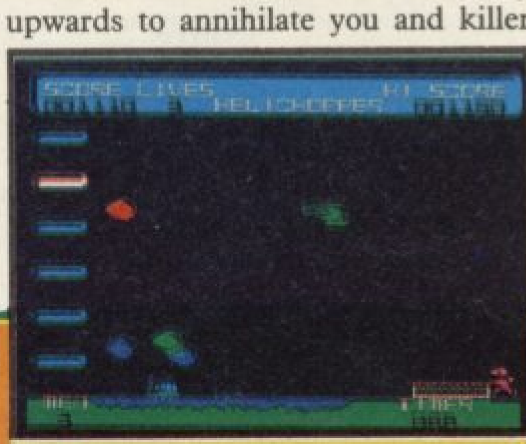
ANOTHER original game of 'grab the survivor and we'll bomb the rest' has been released by Firebird.

Though **Helichopper** scores nothing for innovation, it is saved from being totally awful by fast and clear graphics.

Zip down in your copter and spend a harrowing few moments ferrying a little pink Clone across a duck pond to deposit him on a ladder.

You can only deposit a Clone when the rung above you changes white.

Bombs and balloons move slowly upwards to annihilate you and killer ducks are rife. The chopper has unlimited bombs and you can rain those on the heads of the hapless birds.



Further screens are about as exciting as a wet sponge and follow the same pattern with minor differences.

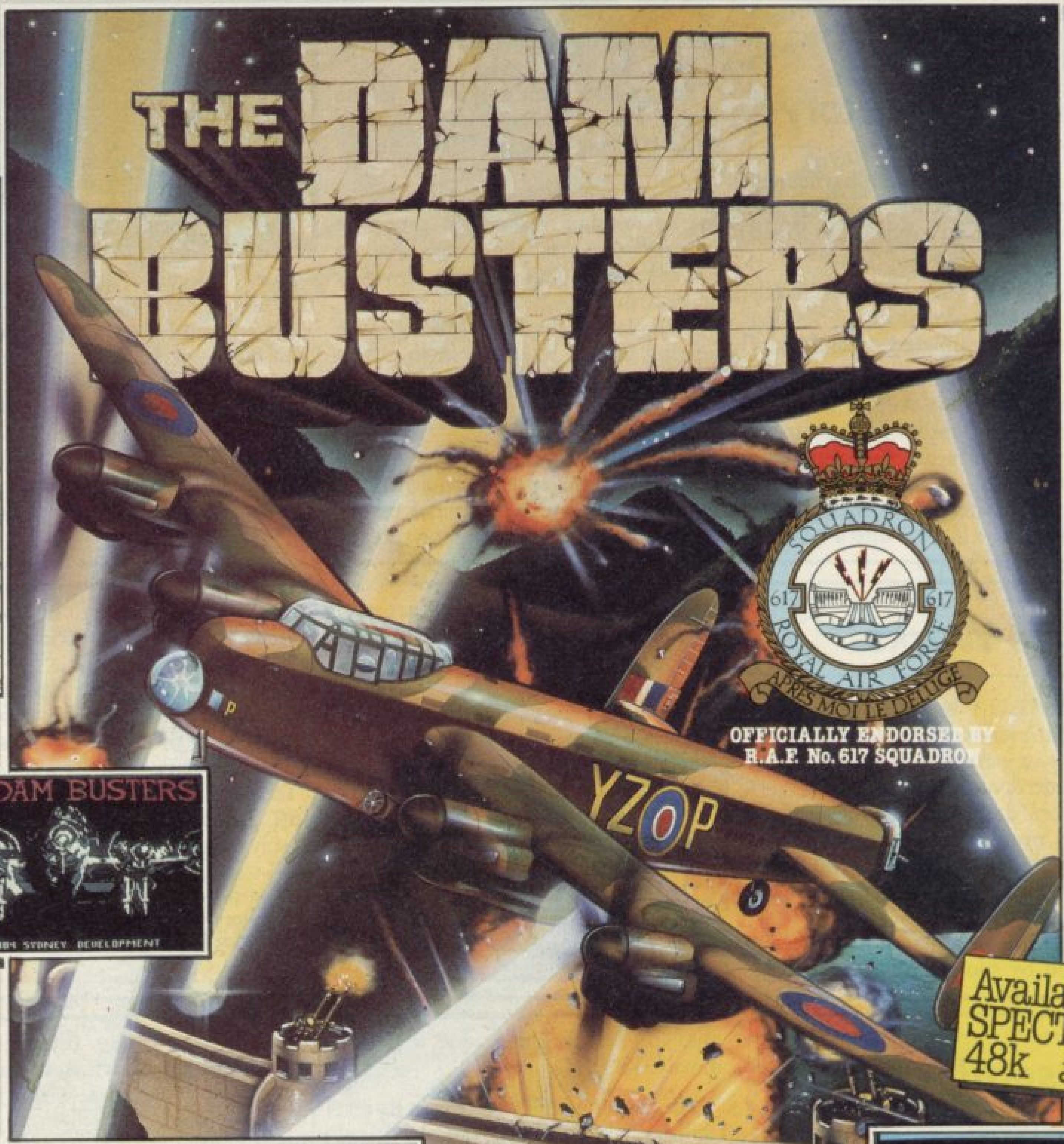
Clare Edgeley

Publisher Firebird **Price** £2.50
Memory 48K **Joystick** Kempston, Sinclair Cursor
★★

more software on page 24

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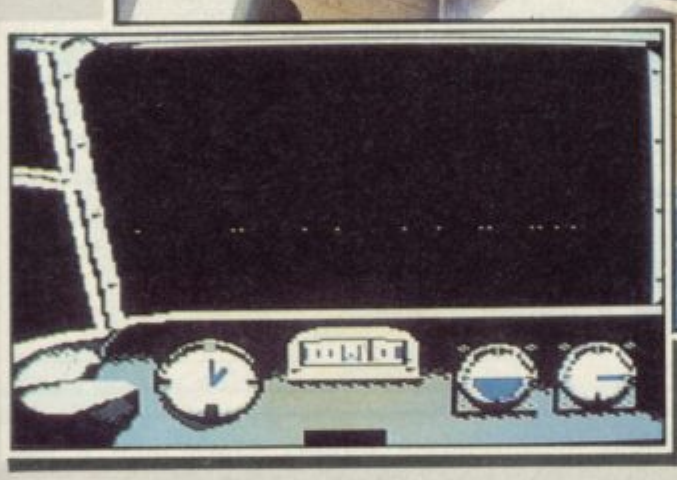
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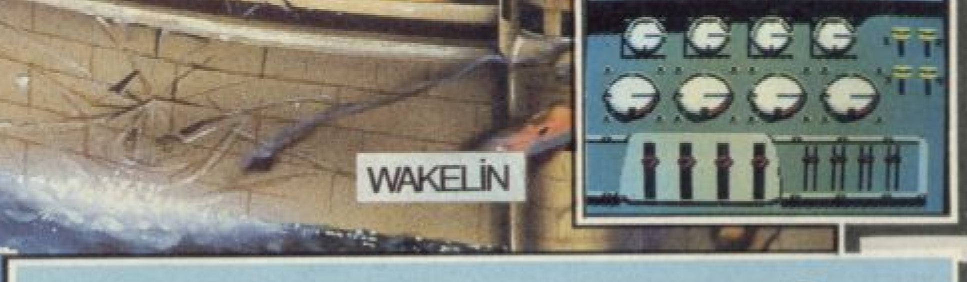
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satisfying game.

Graphics: ****
Sound: ****
Playability: ****
CCI Rating: ****
Company: US Gol
Industrial Estate, H
Birmingham. Tel:





LANCASTER B. MK I/III (DAM BUSTER)

It's 21.15 hours on the evening of May 16th, 1943. A flight of specially prepared Lancaster bombers is leaving R.A.F. Scampton for Germany.

After months of planning No. 617 Squadron are at last embarking on an operation destined to change the course of World War II.

Your objective is to destroy the Mohne, Eder and Sorpe dams, thus crippling Germany's industrial heartland.

This detailed and authentic simulation allows you to play the part of **PILOT, NAVIGATOR, FRONT GUNNER, REAR GUNNER, BOMB AIMER** and **FLIGHT ENGINEER.**

You fly at low altitude over Europe, on the lookout for deadly ME110 night fighters, dodging barrage balloons, searchlights and flak. At the target you'll need all your nerve and skill to control the aircraft and release your deadly payload whilst under enemy attack.

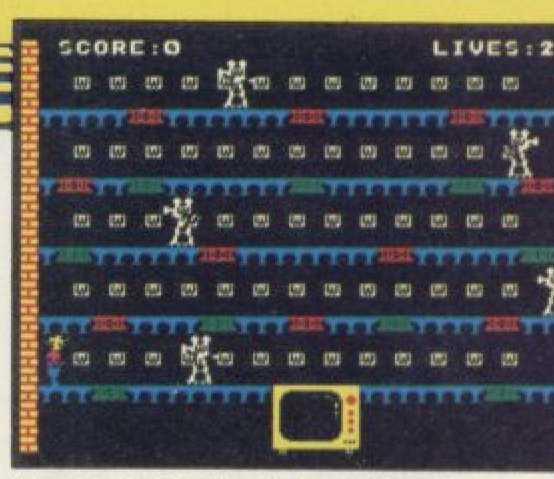
Game features include: **SUPERB GRAPHICS & SOUND · REALISTIC JOYSTICK CONTROL · PILOT'S SCREEN & INDICATORS · MULTIPLE SCREEN NAVIGATOR'S MAPS · FRONT & REAR GUNNER'S SCREEN · BOMB SIGHT SCREEN · ENGINEER'S INDICATORS.**

Game Package includes: Comprehensive flight instructions, maps and confidential documents including authentic material by Barnes Wallis and Wing Commander Guy Gibson.

Designed and Developed by Sydney Development Corporation. Licensed in conjunction with International Computer Group. Manufactured in the U.K. by U.S. Gold Limited, Unit 10, Parkway Industrial Centre, Heneage Street, Birmingham B7 4LY. Telephone: 021-359 8881. Telex: 337268.

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Sydney Development Corp.



Charlie and the Chocolate Factory

HAVE A sticky time in **Charlie and the Chocolate Factory**, based on the renowned children's book by Roald Dahl.

There are five games — four arcade and an arcade adventure. The first four must be completed to gain entry to the final program.

In the first game Augustus Gloop has been sucked into a mass of tubes in the sweet machine. You must run left and right across the screen changing the direction of the tubes so that Augustus will flow into a flask. A pretty game but boring and frustrating to play.

The second game takes you to the juicing room where Violet Beauregarde is being squashed by blueberries.

Veruca Salt has enraged the squirrels in another room and dropping poisoned nuts is the only way to prevent her being thrown down a rubbish shute.

In the last of the four, Mike Teavee is being chased by cameramen out to shrink him with rays of light. He must jump from level to level, picking up Wonka chocolate bars.

The final program is really a 43 room **Jet Set Willy** game and difficult to get into, even in the practice mode. You have to guide Charlie around the factory and collect six golden keys so that he can enter the Great Glass Lift.

Charlie and the Chocolate Factory palls after a very short time. However, as the package comprises five games and the book it must represent reasonable value for money. *Clare Edgely*

Publisher Hill MacGibbon **Price** £9.95
Memory 48K **Joystick** Kempston
★★★

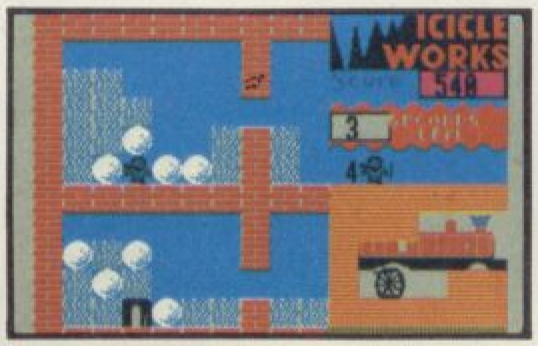
Icicle Works

ORIGINALITY is not a word which springs unbidden to the mind in **Icicle Works** — a game that is based on that old arcade favourite, **Pengy**.

As you dash around the icefield with its precariously balanced snowballs, you have to pick up sections of a jigsaw which make up a picture of a toy.

You will almost certainly be squashed by snowballs, or mauled by cuddly, man-eating polar bears and penguins. There are 13 levels and in each it becomes harder to release the pictures.

The harder levels pose more problems in that you have to kill penguins or polar bears before picking up sections of picture.



Block graphics make up the game and the screen scrolls up, down, left and right in probably the most jerky fashion we have seen for a long time.

Icicle Works is mere kindergarden stuff. Ageing Pengy fans and the rest — stay clear. *Clare Edgeley*

Publisher Statesoft **Price** £6.95
Memory 48K
Joystick Sinclair, Kempston, Protek
★★

Assembler

ASSEMBLY CODE is entered from Basic using REM instructions which can make things easier, if you don't mind entering all those extra instructions. One reason for using Basic is that you can MERGE lines of code together. While that is true most good assemblers these days are able to MERGE routines easily.

The package is a two-pass assembler which normally sends code to RAM above STKEND.

The power of this utility is in its test facilities which include all the usual system diagnostics such as breakpoint insertion, single step through instructions and Trace. Also included are two powerful facilities, Input Instruction and History.

Input Instruction allows the programmer to enter new mnemonic instructions into the code before it is tested.

The History facility provides a display of the changes which the machine code program has made within the last 10 instructions.

It is not the sort of assembler which is a joy to use. The Test facilities mentioned are useful but do not make it worth the expense when there are other, better, products on the market. *John Gilbert*

Publisher Roybot **Price** £9.95
Memory 48K
★★

Plan and Design Your Garden

PLAN AND DESIGN your garden, comes with the book *Garden Planning and Design* – a standard gardening tome with hints on planning and a short section dealing with plants and flowers.

The program content is minimal; 'design' allows you to deposit shapes for vegetables, flowers, buildings and paths on the screen by means of a cursor, while 'diary' is a monthly gardeners' diary and very basic.

Curious anomalies occur, entering 'October' and 'rose' gives you the instruction that roses can be planted next month. Entering 'November' and 'roses' brings up the reply, 'no information found'. Hard luck if you didn't catch the October entry.

There is nothing here that cannot be found in any reasonable gardening book. The whole package is outrageously overpriced. *Theo Wood*

Publisher Blandford Press
Memory 48K **Price** £14.95
★

more software on page 26



Arnhem

THE RACE for the bridge at Arnhem was one of the more daring strategies of World War Two. General Montgomery conceived the plan of a rapid advance across Holland with paratroopers dropped behind the lines to capture the vital river bridges.

Forty years on CCS has conceived the not-so-daring plan of simulating the enterprise in a series of five scenarios culminating in the full-scale battle, Operation Market Garden.

Long-time specialists in wargames, many of which had little merit, CCS seems finally to have cracked it. **Arnhem** is one of the finest computer wargames we have seen, a blend of complex strategy, historical authenticity, and simple, swift operation which will have fans returning for more.

The playing area scrolls over a map of the roads and terrain towards the final bridge. Units are moved in turn, and have an abstract form. You can call up reports on their strengths and efficiency, and issue orders which will be continued on subsequent turns unless cancelled.

The attention given to realism includes the formation of individual units, which can travel fast in condensed form or slowly in open order. The condensed form equates to a column of tanks, for example, which can take advantage of a road for speed but is hampered in combat.

Provision is given for one, two or three players. With three players one player commands the Germans, one the Americans and one the British forces. An introductory scenario can be completed in an hour, and consists of capturing the first bridge at Eindhoven. A full map is provided with a comprehensive booklet.

At the end of the game an assessment is made of your success. If you have failed to advance swiftly you fail, but you may be granted victory anyway, as it is possible to do well enough to make the outcome inevitable.

Wargames of this sort are not for the impatient, nor for the complete novice at strategy. But for those who enjoy simulation wargaming, **Arnhem** is one of the best, and captures the problems of maintaining a swift advance along narrow country roads remarkably well. *Chris Bourne*

Publishers CCS **Price** £8.95
Memory 48K
★★★★★

Battle for Midway

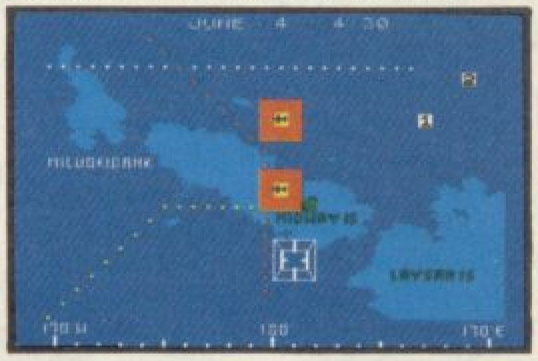
EEEEEOOWWW . . . dakka dakka dakka . . . BOOOMM!!! And another Jap aircraft carrier sinks beneath the blue Pacific.

PSS has produced a passable wargame in **Battle for Midway**, which follows events fairly accurately.

Designer Alan Steel says he wanted to mimic 'The Fog of War', by which he seems to mean not knowing what's going on. That is entirely justifiable, and much of Midway is spent trying to locate the Japanese fleet before it realises you're onto the dastardly plan.

Unfortunately there is not a great deal of subtlety about the best tactics. As soon as you've found the main Japanese attack force, you send as many aircraft after it as you can, until you have sunk all four aircraft carriers. When they are out, the Japanese limp back home again.

The battle sequences are a novelty, using arcade skills. If you are attacked you get a gunsight and must blast the Japanese out of the sky. You also get a gunsight when you try to bomb the Japanese, but it will only shoot down your own planes. Steel says that's to pander to the tastes of arcade freaks, who'll shoot at anything. It looks more like an excuse to use the same piece of code.



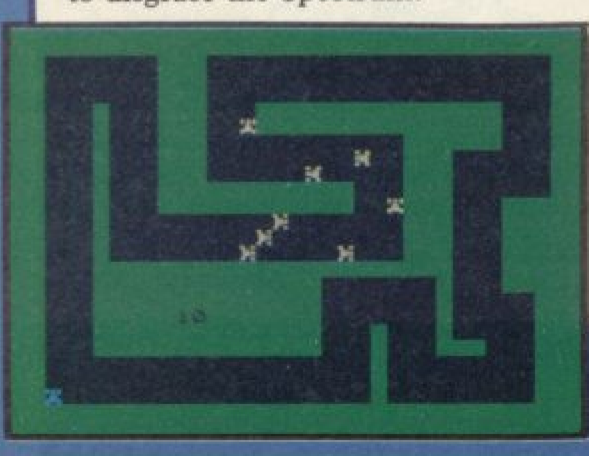
We found it easy to scuttle the Nipponese schemes on level two, the straight historical simulation. There is a level three in which the Japanese are forewarned about your fleets and lay a trap, which might be more difficult.

A few months ago we would have said it was fine. After **Overlords** and **Arnhem**, however, it seems a bit ordinary. *Chris Bourne*

Publisher PSS **Price** £9.95
Memory 48K **Joystick** Kempston, Cursor, Sinclair
★★★

Don't Buy This

WARNING. This cassette contains five of the most uninspired games ever to disgrace the Spectrum.



In **Fido I** and **Fido II** you play Fido the mole bashing pup. When a mole incautiously lifts its head above ground, Fido rushes over, sits down and thumps it with its tail.

Weasel Willy refused to load. The cassette inlay states that 'playing the game is easier than setting the keys'.

Race Ace is the antithesis of any race game ever. It is alternatively too slow and too fast, and to increase playability the control keys are backwards – 'left is left when the kart goes up but right when the kart comes down . . .'

You are advised to play **Fruit Machine** at around four in the morning when you are asleep.

Firebird disclaims all responsibility for the game and states that the product 'may be copied, lent, hired or transmitted at will.' It also advises action if the programming is faulty – put sticky tape over the lug holes and use it as a blank cassette. *Clare Edgeley*

Publisher Firebird **Price** £2.50
Memory 48K **Joystick** Kempston
★★

more software on page 28

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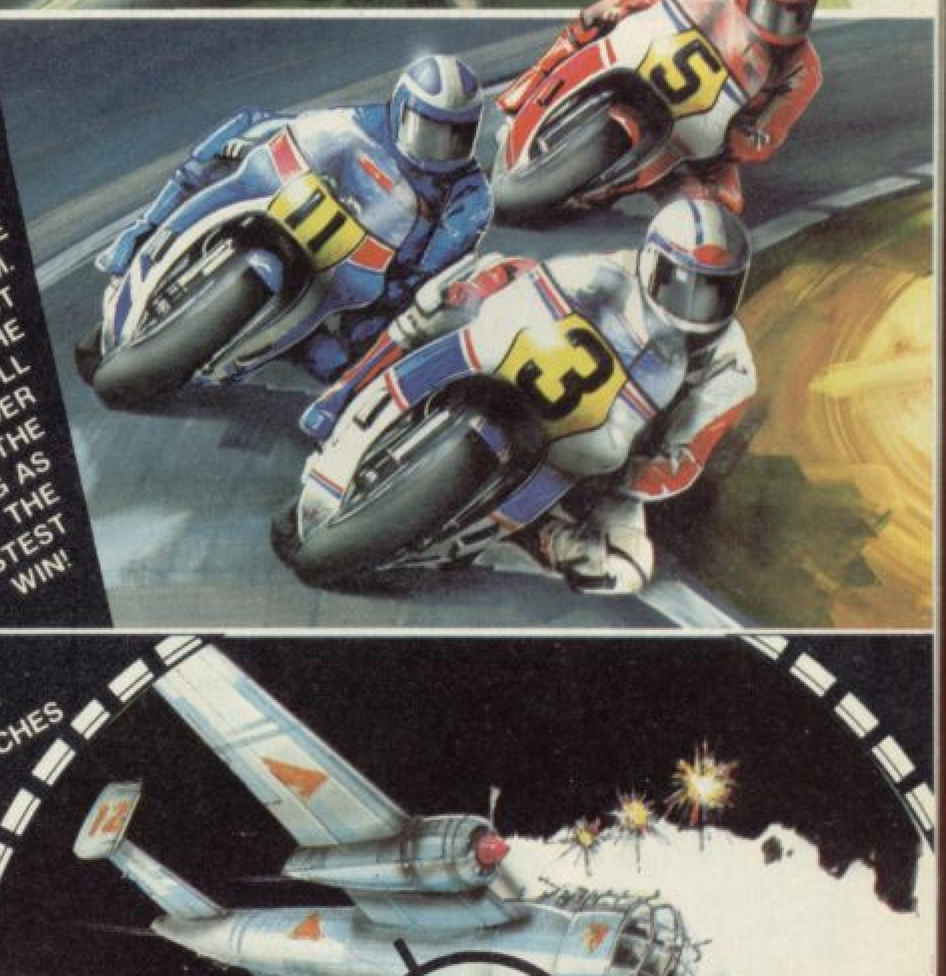
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Locomotion

A GEM has turned up in Mastertronic's range of budget software.

Locomotion is similar to Incentive's **Confuzion**, which itself was by no means original. Despite that it is surprisingly addictive with well graded difficulty levels.

You are a track layer on the railways trying to lay a section of track ahead of a train before it catches up and goes off the rails.

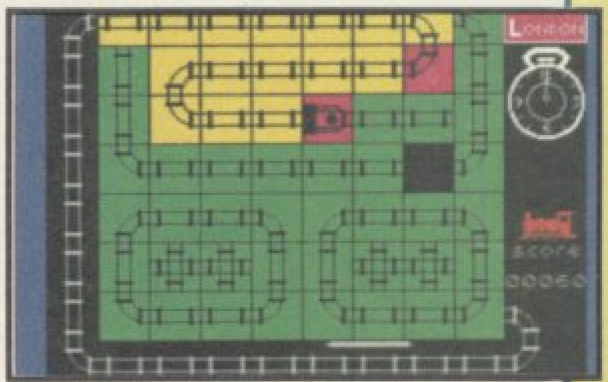
The track is lying around in jumbled sections and you have to create order from chaos in the same way as those slide puzzles where you have one empty space into which to move the tiles.

Assembling the track within the time limit is simple at first but as you move from London to the continent, the tracks from Paris and other stations become progressively more difficult to unjumble and piece together.

The game can be slowed down by depressing the fire button – that will give you one minute's breathing space before the train charges ahead at full speed. Coal and water should be laid along the train's route when ever possible to earn bonus points.

Up to four players can play this simple game which for its price is a bargain. Well worth digging into your pockets for.

Clare Edgeley



Publisher Mastertronic **Price** £2.50
Memory 48K **Joystick** Kempston, Sinclair, Fuller
★★★★

Spacescan Astronomy

THE arrival of Halley's comet in our solar system has generated interest in astronomy.

Spacescan is a program designed to introduce you to star maps and the position of the constellations. Fifteen constellations are displayed with a map, named stars plus some information. Those maps can be printed out for observation. Another program, Starsearch, allows you to search through 75 heavenly bodies. There is also a quiz and a glossary.



Astronomy, by Scisoft, contains similar information but scattered across four programs. The information contained is more detailed and the graphics are not as good as **Spacescan**. Moon phases and Saturn draw are two facilities which could well have been left out, though the Ephemeris section could prove useful. Keen observers could use printouts to identify stars.

Both programs use database techniques but without the stunning graphics found in most astronomy books. As with a great deal of educational software the price seems just too high for what you receive.

Theo Wood

Spacescan
Publisher Macmillan **Memory** 48K
Price £5.95
★★
Astronomy
Publisher Scisoft **Memory** 48K
Price £10.00
★★



Car Cure

SOME software houses persist in believing that loading up illegible text on a flickery screen is preferable to turning the pages of a book.

Car Cure is one such absurd program. It attempts to do the job already done adequately by car maintainance manuals, but unlike those cannot be stored in the glove compartment nor consulted when you break down on the Honiton bypass. Neither does it have any detailed illustrations of the funny oily things located in bewildering abundance under the bonnet.

A manual can be accessed in seconds. **Car Cure** takes four minutes to load, during which time you are invited to solve a maze displayed on the loading screen.

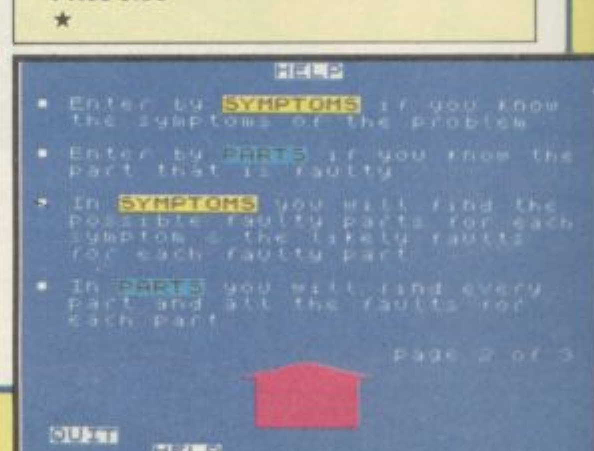
Fault diagnosis is a matter of pinpointing symptom areas such as 'instruments and warning lights', and then narrowing that to a specific problem – for instance, 'ignition warning light won't go off correctly'. All that is done through menus over which you move little arrows.

Having found the best description of your problem, you then move to a further menu listing possible faults. If you're a mechanical novice like me, then you'll give up at this point. After all, if I knew what 'alternator regulator defective' meant then I'd have whipped out my spanner long ago. Assuming, however, that you hazard a guess, you will eventually be rewarded with the comforting screen display: 'competent home mechanics can handle this.' Exactly. I'll have to take it down the garage after all.

Competent home mechanics will have no use for this program. They already own libraries of service manuals and don't need to get oil all over their Spectrum keyboards. Incompetent home mechanics will be totally baffled. Software like this gives computers a bad name.

Bill Scolding

Publisher Simtron **Memory** 48K
Price 9.95
★



Pascal

THE **QL Pascal Development Kit** is a package of which Metacomco can be justly proud. Not only does it conform closely to the ISO-standard so dearly beloved by the business community and schools but also it provides facilities not commonly available on micro-computers.

Until recently software companies would not approach the standard. The reasons given were that any such compiler would need to be based on a mini-computer and that microcomputers just did not have enough memory to accomodate a full implementation.

Metacomco has proved them wrong. Its package contains a ROM on which is included part of the operating system firmware, two microdrive cartridges which contain the runtime editor and compiler, and an excellent and comprehensive Reference Guide.

The ROM is effectively a dongle – software protection – device which must be in the ROM slot if the compiler is to run correctly. On power-up its effects are felt straightaway when a 'welcome' message is displayed. The firmware can be checked, to see if it is in working order, by typing ROM. If 'BAD ROM' is displayed you may have to send the package back to Metacomco.

The Runtime Editor is the same as that which is used in the Metacomco **Assembler, BCPL** and **Lisp** packages. It is a full-screen ASCII file editor which can be used separately, if required, for any Basic or machine code listing. The program uses 20K RAM and needs a further 8K for workspace.

SINCLAIR USER CLASSIC

The one-pass compiler allows the production of a source listing file or a code file. If neither option is chosen the program simply checks the syntax of the source which you have created using the editor.

As well as implementing the ISO standard the compiler will allow the addition of a series of ISO extensions. Those include procedures to allow internal files to access named files, a command which produces a similar effect to that of TRAP in 68000 machine code and a set of routines to deal with QL graphics.

An INCLUDE extension can also be called allowing a user program to call other files or programs. In that way a library of commonly used routines could be built up and used by your programs.

Although the package is not intended for complete beginners the manual accompanying it gives enough information about Pascal for anyone who has knowledge of a high level language, such as Basic, to get started. The package provides a complete Pascal environment and is the most comprehensive and comprehensible on the market.

The price may seem extortionate but similar packages on other micros and minis can cost ten or twenty times as much. The Metacomco package should make other manufacturers sit back and think. *John Gilbert*

Publisher Metacomco
Price £89.95
★★★★★

EVA

IF YOU do not buy **EVA** the author has threatened that he'll send his pet Ninja around to convince you.

He assures us that you will CHEER as you blast the invaders to tatters, QUAIL at the horrendous price of rivets for your gun, CHURN away at the space bar to fire and SHRIEK to the low budget sound effects.

The whole production is a thinly disguised version of Ultimate's **Jetpac** but with the added difficulty of having to get your fingers around the cursor control keys and the space bar.

In this game you have to put together a teleport, which consists of six segments. As each section appears at the top of the screen you must guide it around the platform obstacles to the two red-blocked areas at the bottom. Your space suit generates a magnetic field which draws the part to you. Just click the segment into place and a bleep sounds.

Play is not that easy though as there are the usual red fireballs with which you must contend. Just blast them with your rivet gun.

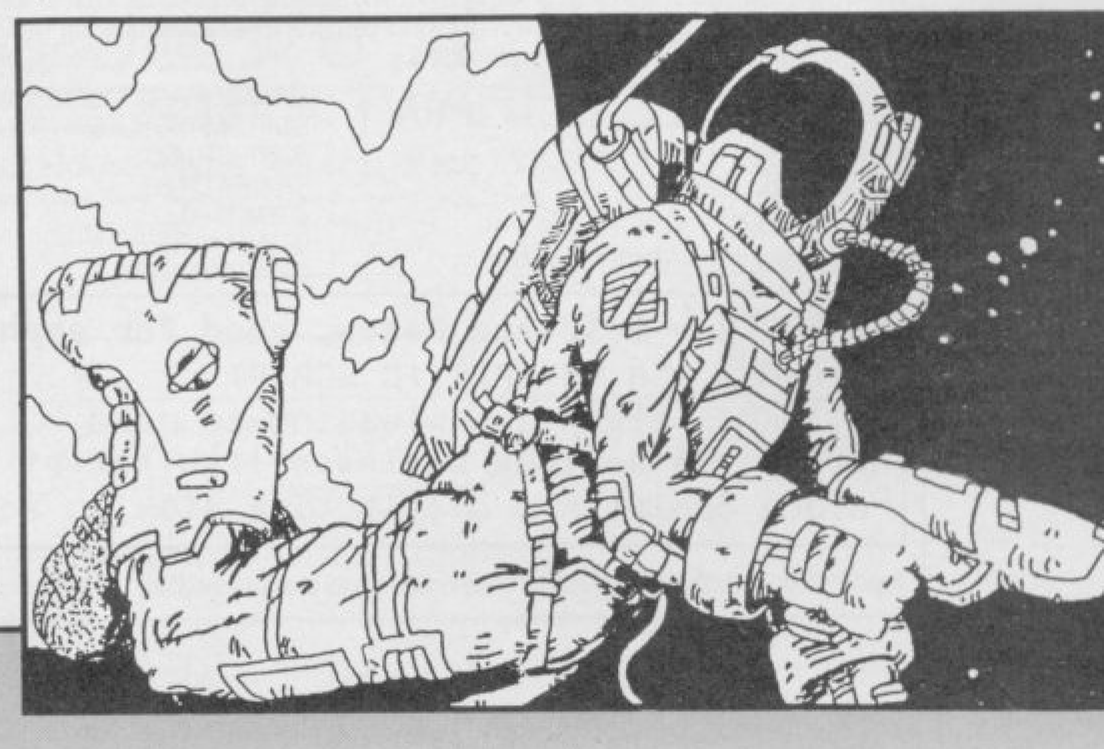
When you have put the transporter together, retaining at least one of four meagre lives, you will be transported to the next screen which has more of the same. If you run out of lives you have to start again or maybe you would like to treat a friend to a thrill and go for the two-player option.

The game, which has the one saving grace of good flicker-free sprites, is little more than a load of cobbled concepts from Spectrum programs. By a fluke it is one of the first QL games on the market but, looking at it, you will see that that posed not problem.

If you have £10 to give away or are anxious to get software – any software – for your machine then buy **EVA**; if not, don't. Now excuse me while I deal with that Ninja . . . *John Gilbert*

Publisher Westway, 24 Preston Road, Lytham, Lancashire FY8 5AA
Price £10.95
★★

more QL software on page 32



MSX · TATUNG EINSTEIN · ZX SPECTRUM · SINCLAIR QL · AMSTRAD CPC 464

Thinking so...
...thi

THE TASWORD WORD PROCESSORS

The extensive features of the Tasword word processors are ideal for both the home and business user. Every Tasword comes complete with a comprehensive manual and a cassette or disc. The cassette or disc contains your TASWORD and TASWORD TUTOR. This teaches you word processing using TASWORD. Whether you have serious applications or simply want to learn about word processing, TASWORD and TASWORD TUTOR make it easy and enjoyable.

TASWORD TWO (Spectrum)

64 characters per line on the screen!

"Without doubt, the best utility I have reviewed for the Spectrum." HOME COMPUTING WEEKLY APRIL 1984

"If you have been looking for a word processor, then look no further." CRASH JUNE 1984

The cassette program is supplied with instructions for microdrive conversion.

TASWORD TWO* ZX 48K Spectrum
cassette **£13.90**
microdrive cartridge **£15.40**

TASWORD 464

"There is no better justification for buying a 464 than this program."
POPULAR COMPUTING WEEKLY NOVEMBER 1984

A particularly sophisticated yet easy to use program. Now available on disc. The cassette version is supplied with instructions for transferring to disc.

TASWORD 464* Amstrad CPC 464
cassette **£19.95**
disc **£22.95**

TASWORD EINSTEIN

A sixty-four character per line display and the ability to hold over five hundred lines of text at any time are just some of the features of this, the most recent, of the Taswords. Full interaction with the disc system – e.g. Tasword detects the presence of added drives and allows their use.

TASWORD EINSTEIN Tatung Einstein
disc **£19.95**

TASWORD MSX

With all the features of the Spectrum Tasword Two including the amazing sixty four character per line display. The Tasword MSX machine code program utilises the 32K of memory not normally available to Basic allowing over five hundred lines of text to be held in memory.

TASWORD MSX* 64K MSX Computers
Fully inclusive mail order price **£13.90**

(cassette includes both disc and tape versions)

THE TASCOPY SCREEN COPIERS

The TASCOPY screen copiers print high resolution screen copies with different dot densities and patterns for the various screen colours. This gives the screen copies a shaded effect which presents on a monochrome scale the colours on the screen. With TASCOPY you can keep a permanent and impressive record of your screen pictures and diagrams. TASCOPY supports all the printers mentioned under TASPRINT.

TASCOPY (Spectrum + Interface 1)

The Spectrum TASCOPY is for use with the RS232 output on ZX Interface 1. It produces monochrome copies (in a choice of two sizes) as well as copies with the shaded "grey scale" effect described above.

TASCOPY ZX Spectrum
cassette **£9.90**
microdrive cartridge **£11.40**

TASCOPY 464

Adds two new commands to the 464 Basic to give both a standard shaded screen copy as well as a "poster size" copy which is printed onto two or four sheets which can be cut and joined to make the poster.

TASCOPY 464 Amstrad CPC464 cassette **£9.90**
disc **£12.90**

TASCOPY QL

TASCOPY QL adds new commands to QL Superbasic. Execute these commands to print a shaded copy of the screen contents. Print the entire screen or just a specified window. TASCOPY QL also produces large "poster size" screen copies on more than one sheet of paper which can then be cut and joined to make the poster, and high speed small copies.

TASCOPY QL Sinclair QL
microdrive cartridge **£12.90**

THE TASPRINT STYLE WRITERS

A must for dot-matrix printer owners! Print your program output and listings in a choice of five impressive print styles. The Tasprints utilise the graphics capabilities of dot matrix printers to form, with a double pass of the printhead, output in a range of five fonts varying from the futuristic data-run to the hand writing simulation of Palace Script. A TASPRINT gives your output originality and style! The TASPRINTS drive all Epson compatible eight pin dot-matrix printers, e.g.

AMSTRAD DMP 1
EPSON FX-80
EPSON RX-80
EPSON MX-80 TYPE III
NEC PC-8023B-N
MANNESMANN TALLY MT-80
STAR DMP 501/515
BROTHER HR5
SHINWA CP-80
COSMOS-80
DATAC PANTHER
DATAC PANTHER II

Five impressive print styles for your use:-

COMPACTA – bold and heavy, good for emphasis
DATA-RUN → A FUTURISTIC SCRIPT
LECTURA – clean and pleasing to read
MEDIAN – a serious business-like script
Palace Script – a distinctive flowing font

Typical Tasprint output. Please note that different makes of printer produce different sized output.

TASPRINT (Spectrum)

Drives all the printer interfaces compatible with TASWORD TWO and can be used to print TASWORD TWO text files as well as output from your own Basic programs.

TASPRINT 48K Spectrum
cassette **£9.90**
microdrive cartridge **£11.40**

TASPRINT 464

Can be used to print AMSWORD/TASWORD 464 text files in addition to output from your own Basic programs. Drives the Amstrad DMP 1 in addition to the printers listed to the left.

TASPRINT 464 Amstrad CPC 464 cassette **£9.90**
disc **£12.90**

TASPRINT QL

TASPRINT QL includes a screen editor used to modify files created by other commercial software such as QUILL, or by the user from BASIC. These modified files include TASPRINT control characters and may be printed, using TASPRINT, in one or more of the unique TASPRINT fonts.

TASPRINT QL Sinclair QL
microdrive cartridge **£19.95**

Cartridge Doctor

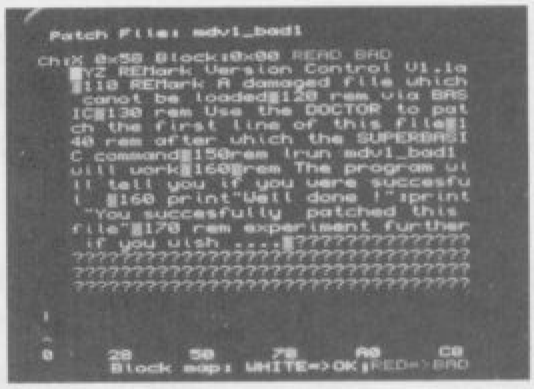
HAVE YOUR microdrives got the floppies? Had any data recovery problems lately? What you need is **Cartridge Doctor**.

The package, which includes five routines, will clone files, recover data which has become lost or scrambled and, if you know a bit about the internal workings of the QL, recover files which you have deleted from a cartridge directory.

The Autoclone facility can be used to back-up programs or copy complete cartridges. Unfortunately it is not a rapid copier, and can take three or four minutes to clone, but it will copy almost anything and recover files which have been accidentally deleted. It will allow you to scan a cartridge to identify 'bad' files.

File Patch can be put into operation when a bad file is found. It loads a file block into memory and displays it on the screen in ASCII format. You can then use a cursor to correct any corruption of the block which may show up. For instance, you may load in a Basic program which has become corrupted. You find that the first line has been changed from 10 PRINT "HELLO" to AS?NT "HELLO". All you have to do is use the cursor to correct the errors and re-save the program.

Badly damaged files, and those without headers, can be treated using the Salvage section of the package. All you need to do is to create a new file of similar length to the one which has been damaged, patch the original offending blocks, and read them out to the file which you have just created. In that way you can find a damaged file and repair it without having to



refer to its name on the header, which may be damaged.

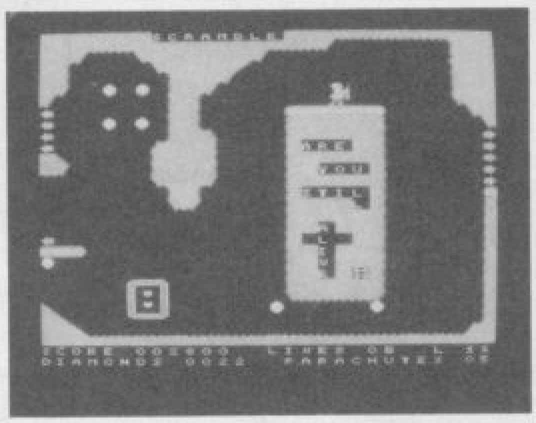
The package is easy to use and a must for any of you out there who keep losing files – there can't be that many, surely. Just remember that **Cartridge Doctor** kills 99 percent of floppy bugs dead! *John Gilbert*

Publisher Talent, Current Building, 101 St James Road, Glasgow, G4 0NS
Price £21.95
★★★★★

QL Caverns

ENTER the world of Willy on the QL, or someone who looks like him. Sinclair Research has given him the name BJ and he's been captured by aliens who have forced him into a mine to collect 395 diamonds.

Caverns is in the classic platform game mould except for three differences. The first provides BJ with a jetpack. It can be used to hover in caverns with dangerous blue walls which would be the death of our hero. BJ can bend down and walk through narrow tunnels. He can also bounce to the upper levels of the caverns using



handily placed trampolines.

Lives are easy to lose so heart-shaped lives are scattered around waiting to be collected. Most are carefully guarded by aliens with which you may collide if you jump too high, so don't be too ambitious.

Although there seem to be, oh, dozens of caves within Caverns, when you've seen five you've more of less seen them all. Movement is achieved with the cursor keys; we tried a joystick with the game but could not stop BJ from jumping.

If **QL Caverns** is going to be the standard of games from Sinclair then I wish it had kept its promise, and its intentions, not to launch any games. That was more than a year ago, though, and a lot can change in that time. *John Gilbert*

Publishers Sinclair Research
Price £10.95
Joystick
★★★

QL Agenda

IF **QL Agenda** is an example of what new company Q-Soft is doing then the future does not bode well.

The utility combines a diary with a calendar for any month of any year. After you have waited three minutes for the diary to load you are asked to enter the current year, date and time. A calendar is then computed and the first two months are displayed at the right of the screen.

At the top of the display the current options are shown. The Design function can be used to change baud rate, toggle printer output and sound and set the alarm. You can also load in a file of data or create a new agenda.

Each year requires one microdrive cartridge to store data and the package contains a utility to back-up data as well as the master program. That seems extravagant for one program when you can store at least three or four massive documents on one cartridge using **Quill**.

Once you have created an agenda you can enter your appointments for a specific year and month using a window at the left of the screen. It displays lines numbered from one to 15 and you use those index numbers to set something on a line.

Each line can contain 28 characters. If you type more, then part of your note is truncated. The other major problem is that you cannot edit the agenda to insert appointments between other entries.

Unfortunately that makes the package's prime use as a time-sequenced appointments file obsolete.

It would be quicker and easier to use a desk diary. It might also prove less expensive — unless you want to try and convince Inland Revenue that your QL is a tax loss. *John Gilbert*

Publisher Q-Soft, PO Box 90, Barnet, Hertfordshire EN5 5RN **Price** £19.95
★

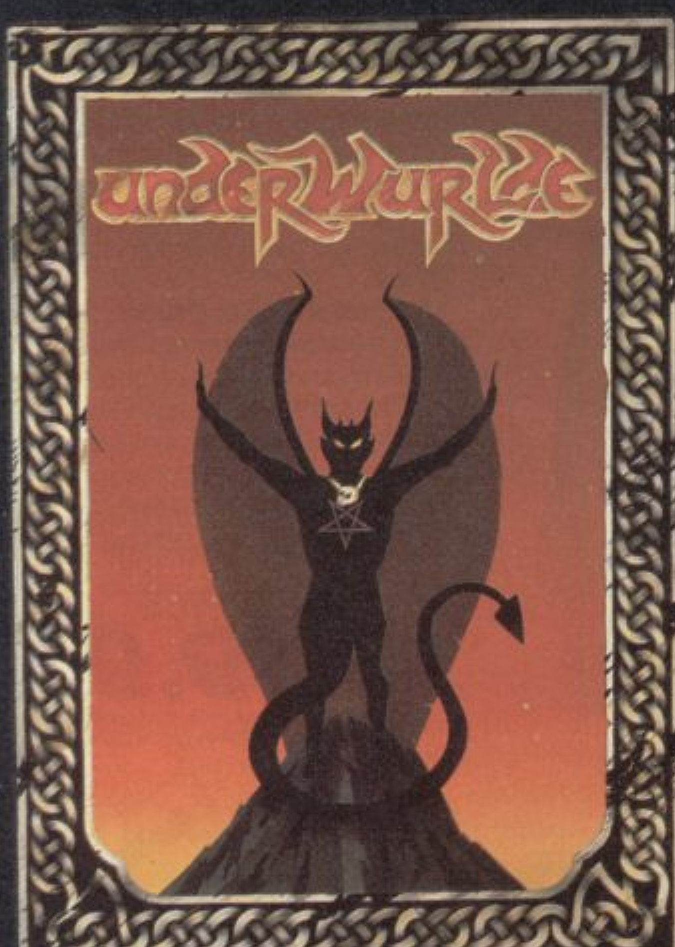

Herbert's
Dummy Run
Trouble In Store for Herbert
Spectrum 48K £9.95
Commodore 64 £9.95
Amstrad CPC 464 £9.95
SOFTWARE HOUSE OF THE YEAR
Commended
GOLDEN JOYSTICK AWARDS
MIKRO-GEN
44 The Broadway, Bracknell, Berks. 0344 427317

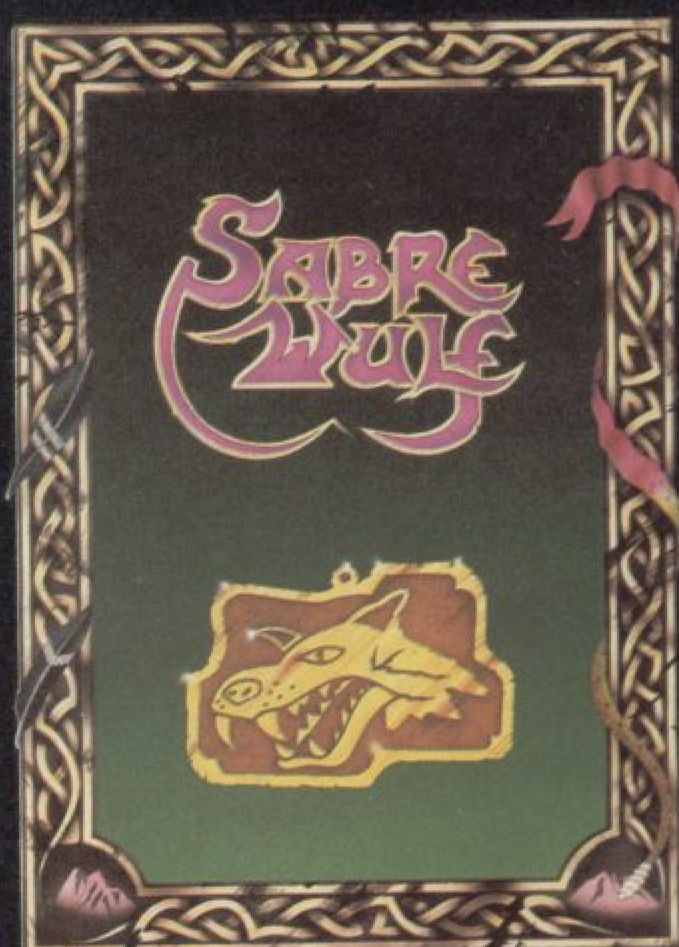
ULTIMATE PLAY THE GAME

48K SINCLAIR ZX SPECTRUM



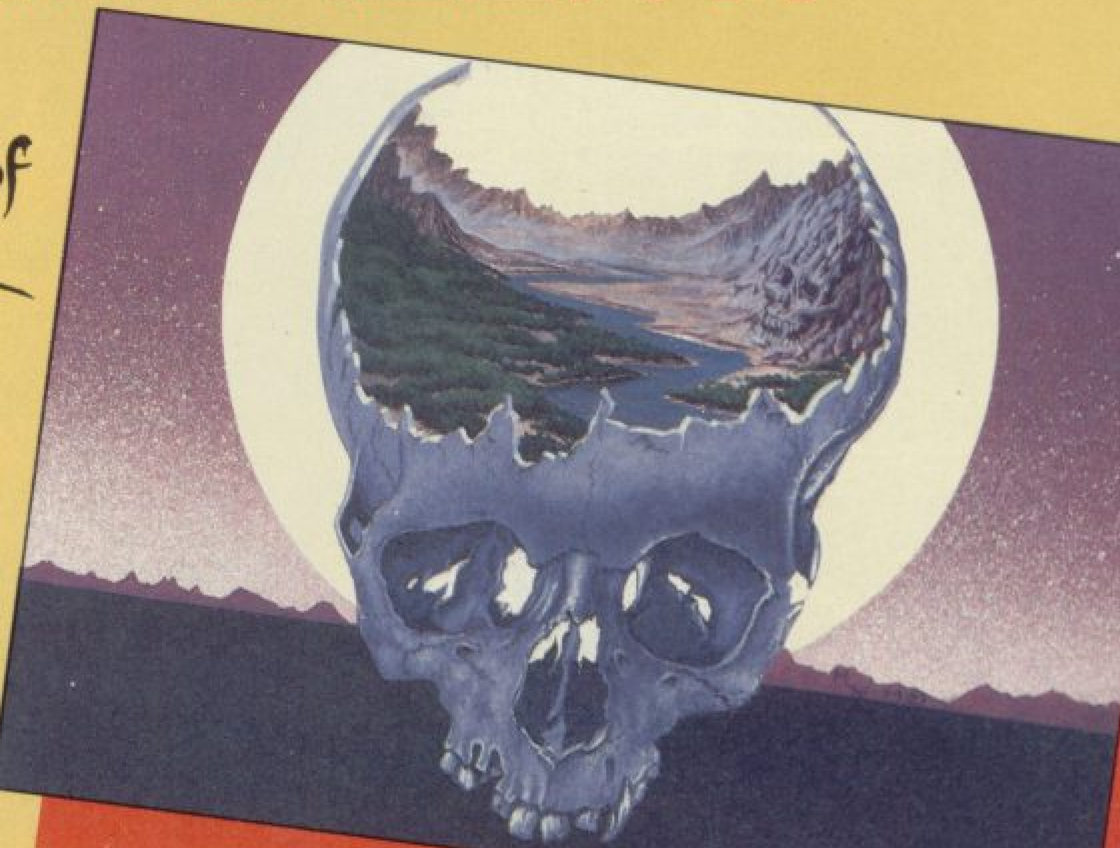






"ALIEN 8", "KNIGHTLORE", "UNDERWURLDE" and "SABRE WULF" recommended retail price £9.95 inc VAT. Available from W.H.SMITHS, BOOTS, J.MENZIES, WOOLWORTHS and all good software retail outlets. Also available from ULTIMATE PLAY THE GAME, The Green, Ashby-de-la-Zouch, Leicestershire LE6 5JU (P&P are included) Tel: 0530 411485

The first QL adventures from TALENT!



The Lost Kingdom of ZKUL

Explore the ancient dwelling-place of the Dwarves – where the Wizard guards the last precious secret.

A classic and complex text adventure with hundreds of locations and a huge vocabulary. Set in real-time with traps, tasks, puzzles and mazes – and a special note-pad feature to aid you.

"the quality of the game is superb"
Micro Adventurer

PRICE
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+ 50p postage and packing



WEST

You are on the track of a notorious gang of bank robbers who have gone to ground near an abandoned mining town deep in Indian territory. Your task – to outwit and outgun the robbers, collect as much loot as possible and piece together clues on how to escape.

A demanding and exciting text adventure for the experienced games-player, using over 200 words and as many phrases. There are over 130 locations to search – not all of them easy to find. Events happen in real-time outside your control – Indians charge, rattle-snakes slither past and robbers appear and shoot at you. How long can you survive?

PRICE
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+ 50p postage and packing
(Also on CBM 64, BBC & Electron)

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A QCON out of the ashes

THE DEMISE of OEL left Sinclair with rather more egg on its face than usual. It had just spent a bob or two on full page colour adverts for QCOM, a communications/modem package for the QL, and by the time the ads appeared, OEL had disappeared.

Tandata, who already supplies a number of very nice modems for other computers, has now taken up QCOM and the finished product should be available soon.

QCOM comprises three parts, QCON, QCALL and QMOD, which stack neatly on top of one another and are styled to match the QL. The base unit, QCON, is the heart of the system and is the minimum required; the other units are optional.

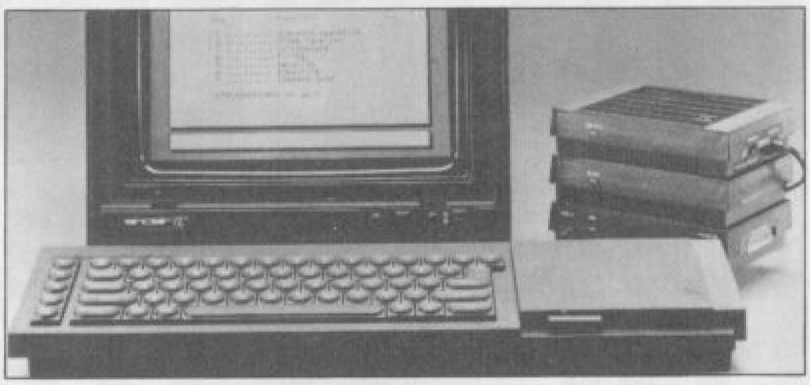
QCALL provides auto dial and auto answer and QMOD is the modem.

QCON connects to the QL SER2 port and takes its power direct from the QL power supply, the QL is then powered from QCON. It is supplied with the Scion software and it is that which makes it so good.

The Scion software loads in two stages; first a short Basic boot program which asks you to input the date and time, and then the code proper. A main menu is displayed with everything neatly laid out and windowed, and from that follows a series of sub menus.

The first option, and probably the one which will get most use, is Viewdata, through which you can access Prestel.

The second option is entitled VT100 and is a full terminal emulation of the industry standard for connection to mainframes. The sub menu allows you to log on, hang up, alter various settings — which can be saved for future use or reset to default or go into terminal mode. These options are standard but QCON comes into its own with the next four.



Switchboard, option three, is the phonebook which stores pages of telephone numbers. Each page has its own default settings, which can be changed. Each entry has several options, the 'phone number can be set on dial and there is space for a comment. That last can be set so that it is automatically sent when you log on.

Option four gives you access to the QDOS filing system and with this you can list or delete a file, and obtain a directory.

The last two options on the main menu allow you to build a file of commands and run them. The commands available are quite extensive; if you had QCALL connected you could set it to 'phone Prestel at a certain time, access a page, save it to microdrive, and hang up.

The limitations to the system is QMOD. It can only run at 1200 or 75 baud, and although many information providers use those rates, 300 baud is still popular. OEL had applied for British Telecom approval but the process was suspended when the company ran into difficulties.

The prices of the individual units are QCON £89.95, QCALL £49.95 and QMOD £79.95 — a total price of £219.85.

For further details and availability contact Tandata Marketing Ltd, Albert Road North, Malvern, Worcestershire WR14 2TL. Tel: 06845 68421.

Quest slips big discs

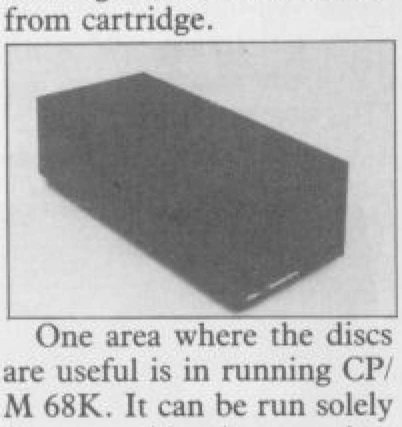
QUEST was one of the first companies to announce support for the QL with both hardware and software. Last month we looked at its add-on RAM, and this month we turn to disc drives and the CP/M 68K operating system.

The disc interface is housed in the same, over large, case as the RAM.

Before the drives can be used the disc operating system has to be loaded from microdrive, — an archaic practice, but otherwise the EPROM-based software would interfere with running CP/M. The result is that memory is used up which, if you load a large program, such as Quill, requires it to access the disc more often than would otherwise by necessary.

Once up and running the disc behaves in much the same way as a microdrive, using FDV in place of MDV. It competes with the microdrive in speed, and loses. Saving can take up to twice as long, although loading is quicker. Booting a program takes an age.

To format a disc the software again has to be loaded from cartridge.



One area where the discs are useful is in running CP/M 68K. It can be run solely from cartridge but requires an additional operating system card. We looked at the disc-based system, as with the DOS it has to be booted from cartridge. The microdrives are treated as A> and B>, floppies as C> and D>.

CP/M 68K is supplied with a large manual and two discs with a number of utilities. The discs contain a C compiler, an assembler and a text file.

The system can read and write files to IBM format discs and there is a utility which will convert QDOS files to CP/M 68K format.

CP/M 68K costs £59.50 on disc, £99.50 on cartridge. The disc drives, all 5¼in including interface, are 1×200K £295.00, 1×400K £419.00, 1×800K £499.00, 2×200K £469.00, 2×400K £579.00 and 2×800K £695.00.

If you are looking for a disc system only then there are better and cheaper ones available. If you want to run CP/M 68K then this is the only system around.

Contact Quest Automation Plc, School Lane, Chandler's Ford, Hampshire SO5 3YY. Tel: 04215-66321.

The Rotronics Wafadrive 'Peripheral of the Year'*

The Computer Trade Association/Leisure Electronics Trader Peripheral of the Year Award. Personal Computer News Best Buy. And nominated for the British Micro Awards. All these successes are a result of Wafadrive's transformation of Spectrum data storage.

Now, the power and convenience of floppy disk can be yours, but at a fraction of the cost – only £129.95!

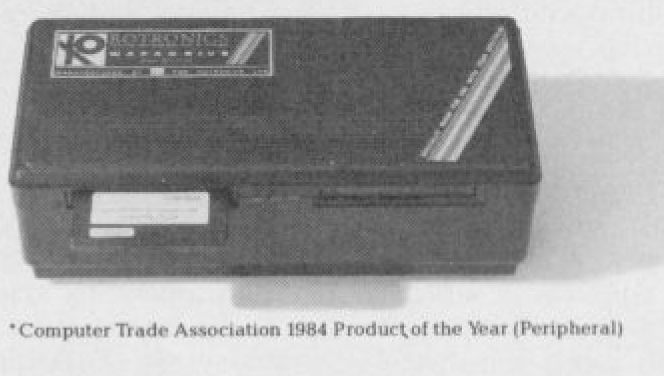
Wafadrive houses five major components – micro interface, two 128K drives, RS232 serial and Centronics parallel ports – all within one compact unit. We've also included Spectral Writer – a superb word processing program – and a blank wafer. So you can start operating straight away.

Wafers are available in three sizes – 128K, 64K and 16K. All load well over ten times as fast as cassette, and their data integrity is on a par with floppy disk!

You'll find a rapidly growing range of software from games to business applications.

Find out more about the Wafadrive revolution. Ring us on High Wycombe 452757 or write to Rotronics Limited, Santosh House, Marlborough Trading Estate, West Wycombe Road, High Wycombe, Bucks HP11 2LB. We'll send you our full colour brochure by return.

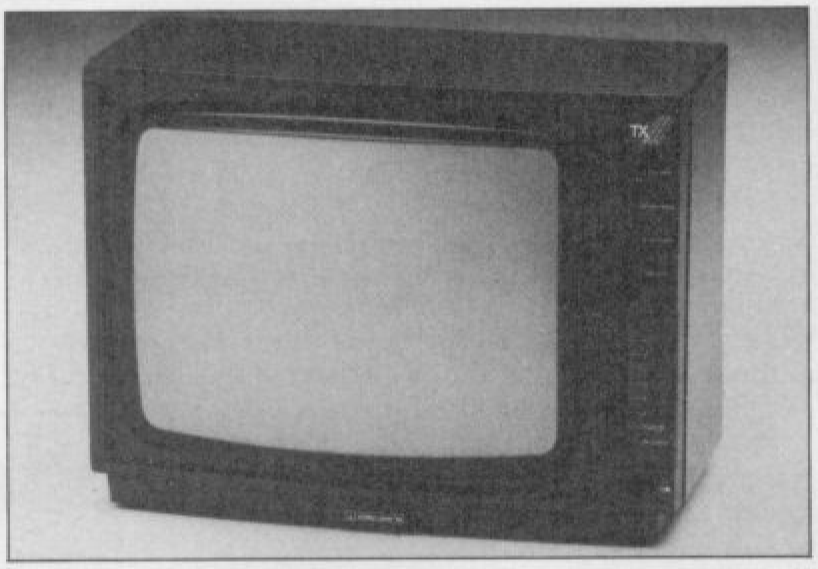
ROTRONICS



*Computer Trade Association 1984 Product of the Year (Peripheral)

the Spectrum storage system

A jack of all trades



THE NEW combined TV monitors are at best a compromise, and the Ferguson MCO1 is no exception; it is a jack of all trades.

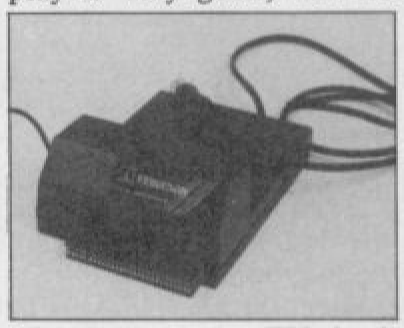
The MCO1 can be used by both the Spectrum and the QL when running as a TV and as a monitor with adaptors from Ferguson. The QL adaptor is a suitable lead, code No MA17 and priced £5.85, which connects the QL RGB socket to the back of the TV. There is also a composite video socket on the MCO1 which could be driven from the QL, but you would have to make your own lead for this.

To get RGB from the Spectrum, Ferguson can supply the MA20, priced £29.95, which converts the composite video output at the edge connector — which means it will only work on issue three or later — to TTL RGB. With TTL, brightness cannot be shown.

The adaptor has a through port for other add-ons, a 'green screen' switch which gives a green and black display, and a colour control for the RGB.

The TV has the normal volume, brightness, contrast and colour controls — the last two are inoperable when running RGB — plus eight push-button channel selectors. Channel seven is used for RGB, and eight for composite video. On the back are the RGB, composite video and aerial sockets with an additional earphone socket. There are no accessable positioning controls.

The TV picture is only adequate. Running the computers in this mode gives a reasonable display but, with the QL, is a little indistinct. In RGB mode the QL display is very good, but the



picture is only TV-sized. When running the QL in monitor mode the edges of the picture are lost.

The Spectrum display, using the MA20 adaptor, is variable. For high definition work, such as **Tasword 2**, in black and white there is a slight ghosting to the right of the characters.

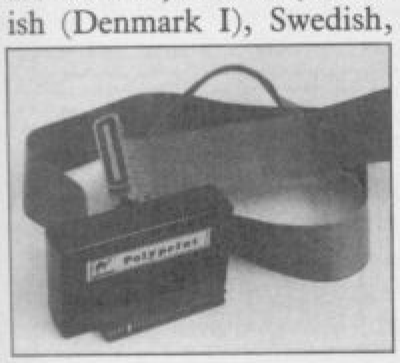
The MCO1 is a reasonable product and, within limits, it performs well. It is not as good as separate units, but then it is considerably cheaper at £229.

Wanted: use for pretty poly print

LINGUISTS will welcome Polyprint from Cambridge MicroElectronics. As well as being an Eprom-based Centronics printer interface it gives instant access to six different international character sets, any one of which can be displayed on screen in place of the standard Spectrum set.

It can be used with **Tasword 2** and will display the same international characters in both 64 character and 32 character modes.

The international characters are based on those used by the Epson '80 series of printers, the RX80 and FX80, so the printer can easily reproduce them. They are French, German, Danish (Denmark I), Swedish, Italian and Spanish. The screen copy routine is also set up for Epson compatible printers.



It is one of the most user-unfriendly interfaces I have used for a long time. On power up you must enter the sequence OUT 959,255: OUT 959,120: OUT 703,128: RANDOMIZE USER 15360, to direct LPRINT and LLIST.

Changing character sets is performed by a single OUT command, apart from Italian, which requires another long Basic line; the printer must be switched separately. The COPY command is implemented using a RAND USER statement, and only one size is available.

Linguists apart, it is difficult to know to whom Polyprint will appeal. Having different character sets is useful but only one can be used at any one time which is potentially limiting.

Tasword 2 is available in a number of different languages, including Dutch, Flemish, Cyrillic and Icelandic.

The main drawback to Polyprint is the price, £51.69, which compared to the Kempston 'E' and Euroelectronics LPrint III is high. Contact Cambridge MicroElectronics Ltd, One Milton Road, Cambridge.

Disc doubler

SINGLE-SIDED discs usually have a magnetic coating on the other side which though not up to standard is still usable.

The Disc Doubler cuts a 'write protect' notch in the disc so that you can turn it over to access the other side.

To discover if it will work cover up the timing with opaque sticky tape, taking care not to stick the magnetic disc to it, and try to access the disc. If the message 'Write Protect' is displayed then the Doubler should work.

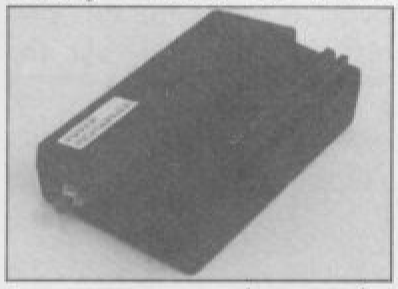


The Disc Doubler costs only £15.00 inclusive, and if it works on your system will pay for itself in no time at all. Details from Associated Computer Marketing Ltd, 54 Grosvenor Road, Aldershot, Hampshire.

more hardware on page 40

Microdrive master

MAKING microdrive copies of your own programs for your own use is not illegal as far as I know, but can be extremely difficult. If you bought a microdrive to speed the loading of your favourite games – the main reason for most people buying them – then it is doubly difficult due to the memory space taken up by the microdrive.



Help, however, is at hand. The Microdriver, from Mirage Microcomputers, is a piece of hardware for the Spectrum which allows you to make a backup copy of any program to microdrive at the push of a button. As the Microdriver has to be connected to the computer to re-load any programs saved using it, it will be of little use to commercial pirates but it is a boon to the home user.

Using the Microdriver is simple. A program is loaded in the normal way, with the Microdriver attached, and at any time – even in mid zap – you can push the button on it and the computer is stopped. A menu appears with a number of options and, once you have made your choice, the program can be started at the same point at which it was stopped.

The menu options are Load and Save; Poke, which allows you to enter those infinitive lives; Run, to restart a program; or New, which clears the computer. All options are error-trapped. If you are saving to microdrive and the program exists, you are given the option of overwriting it. In this way, in an adventure program you can save your current position without having to start at the beginning every time.

As the Microdriver is hardware-based it is almost impossible to protect a program from it. If you have a microdrive the Microdriver is the most important piece of hardware you could buy.

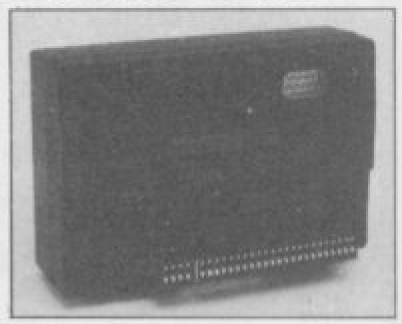
The price, £39.95, is a little high, considering the dearth of components inside, but its features still make it good value. For more information contact Mirage Microcomputers Ltd, 24 Bank Street, Braintree, Essex, CM7 7UL. Tel: 0376 48321.

No dead ends

KEMPSTON compatible joystick interfaces are plentiful but many suffer from being 'dead ended' — they have no through connector for other add-ons.

The latest interface from Cheetah is available both with and without a through connector, £12.75 with and £11.50 without.

Both should stand many hours of alien zapping. For further information contact Cheetah Marketing Ltd, 24 Ray Street, London EC1R 3DJ. Tel 01-833 4909.



Drawing with flair and Style



A GRAPHICS tablet is a device which has an electronic pen and a special surface on which to draw. As the pen is moved across the surface, software translates the position of the pen and reproduces it on screen.

Saga Systems has allowed *Sinclair User* an exclusive preview of Style, a package of interface plus drawing software, priced at £29.95 inclusive, and a graphics tablet priced at £69.95 plus VAT. This compares well with other Spectrum tablets.

Initially the interface and software can be used with an ordinary joystick, and at a later stage, you can splash out on the graphics tablet. As a bonus the interface doubles as a Kempston compatible joystick interface.

The interface contains a two channel analogue-to-digital converter, so the technically minded could use it with their own analogue joystick or, with their own software, to input sound.

The software with the interface is comprehensive and easy to use. All the usual features are included – freehand drawing, straight lines, points and circles as well as elastic banded boxes and triangles.

You can zoom in on any part of the screen and magnify it by a factor of eight for detailed work, erase bits of the picture, fill them with ink, or add text. In order to keep track of where the character squares are, when colouring the drawing, a grid can be overlaid to highlight them. You must remember not to overlay the grid once you have started adding colour, otherwise the colours will be removed.

To colour the picture you can either change the attributes globally – over the whole picture – or locally, at the pen position.

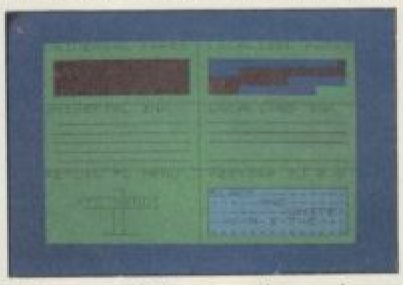
The software has some nice features. Once it has been loaded you are presented with a menu, to



which the program always returns without losing the picture. The pen is used to select the option – icons are used on some which makes selection easier.

Once you are in the desired mode, for example, freehand drawing, a cursor is displayed on the screen as you move the pen around. There is a button on the left of the graphics tablet and when you press this the pen starts to draw.

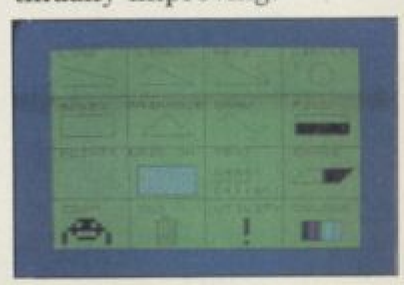
Two brush effects are available; either a solid line or stipple. Drawing solid lines is quick, while shading has to be done more slowly. Fill also has two modes,



either solid or using alternate lines.

No product ever does everything you want in the way you want it to, and Style is no exception. Saga is aware of this and is open to suggested improvements, which might well be included in later versions.

Whether you just want to draw pictures for your own amusement, or to produce the ultimate loading screen then Style is a good way of producing them. The software is not up to the standard of some drawing programs now available but it is readily usable and continually improving.



For further details contact Saga Systems Ltd, Gran Haig House, Woodham Road, Woking, Surrey. Tel: 04862 22977.

Add on a new keyboard

NOW may not be the best time to launch a new add-on keyboard for the Spectrum, following so soon after the introduction of the Spectrum Plus, but the 68FX2 from LMT might tempt even owners of those to upgrade their computer.

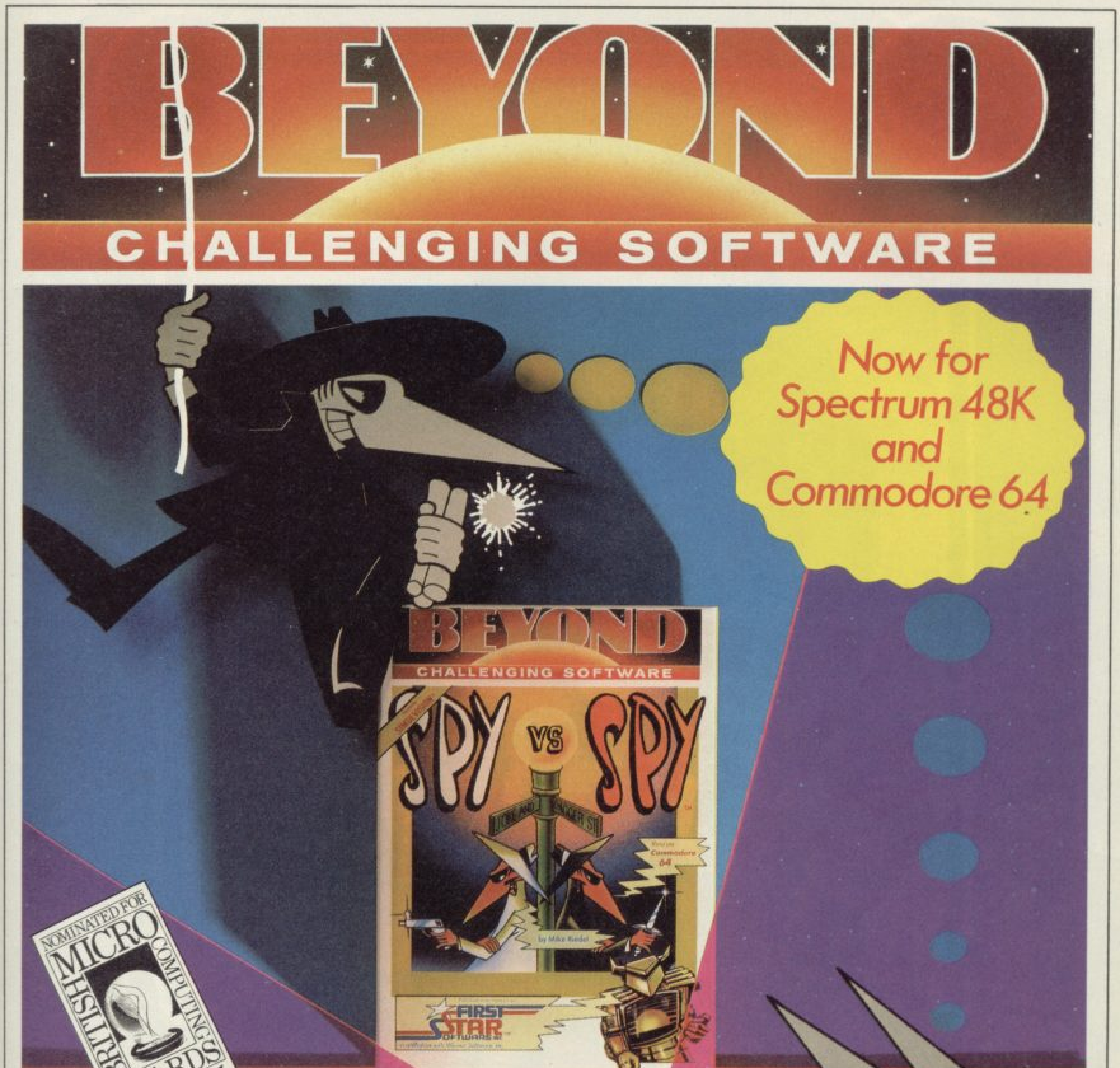
Not only does the 68FX2 use moving keys but there are 68 of them, including many single key functions, and all for only £39.95.

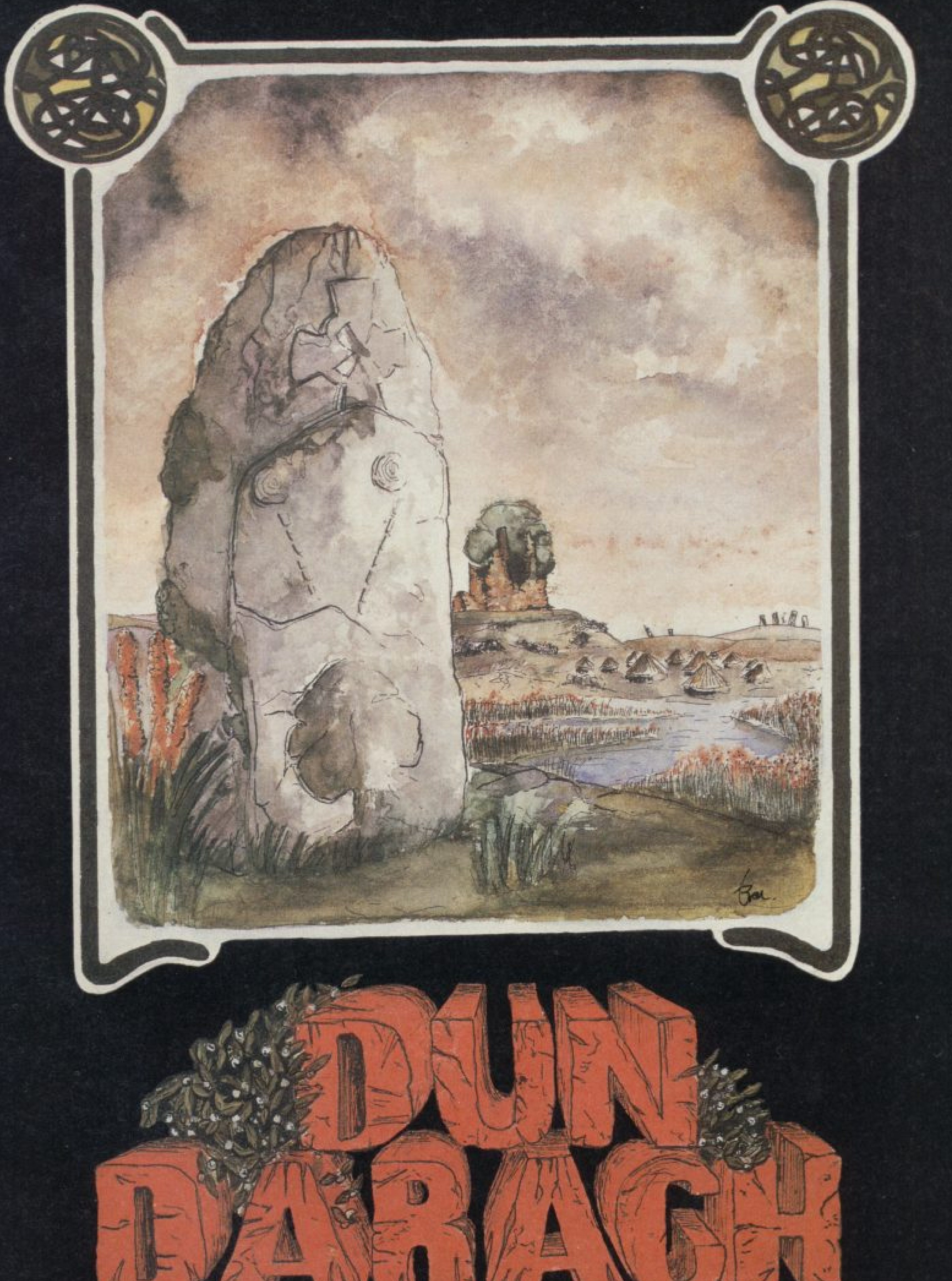
Fifteen of the keys are on a separate numeric pad giving the numbers 0 to 9, plus, divide, multiply, subtract, and point (full stop) as single key functions, and Enter. On the main keyboard, which includes a full-sized space bar, are two oversized Caps Shift keys, four shifted cursor keys, Edit, Delete, Break, Graphics, Caps Lock, Extended Mode, Run, and Comma.

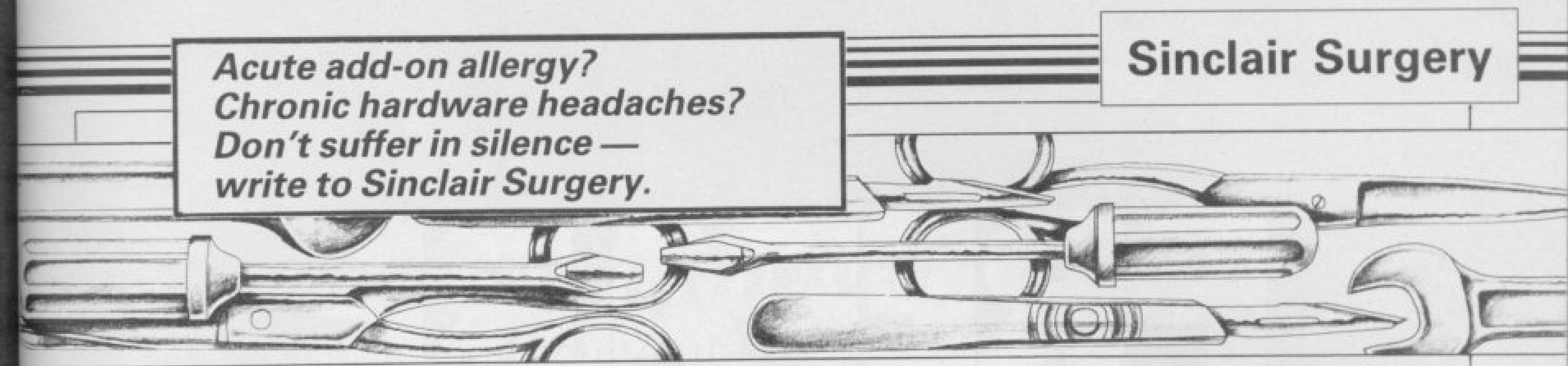
Interface 1 fits under the keyboard which is also designed to take LMT's proposed disc interface and printer port internally.

At the price the nearest rival is the DK'tronics keyboard which, with the extra printed key caps, is more expensive and offers fewer features. The Enter key has been moved up a line, to Q-P from A-L, which takes some getting used to.

For further details contact LMT Computers, Unit 2, 274 Baker Street, Enfield, Middlesex EN1 3LS. Tel: 01-367 0035.


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Wear and tear on Wafadrive

RECENTLY I purchased a Rotronics Wafadrive but one or two problems have emerged. When initially switching on, using my monochrome VDU, the screen will often display a series of vertical broad stripes, or a pattern of flashing rectangles, or one large black rectangle within the border frame, or a series of question marks after the Sinclair logo.

Under those conditions NEW* will not ENTER to initialise the Wafadrive and only plugging and unplugging the power supply several times eventually gives me a condition whereby NEW* works.

How can I obtain a Wafadrive version of the **Vu-File** datafile program.

Barrie Rhodes,
Rodley,
Leeds

● *The probable cause of this is that the edge connector is dirty or worn. Try cleaning it with a preparitory cleaner or an Indian rubber. If this does not work contact Rotronics. To copy* **Vu-File** *to wafadrive you will need a commercial copier.*

Transferring to diskette

I RECENTLY bought a Shughart SA200, 5¼in slimline, single sided, single density, soft sectored disk drive for my Spectrum — 8K at the top of RAM is reserved for the system.

I have been able to save Basic programs on diskettes but I have so far been unable to transfer commercial programs from tape to disk.

Could you suggest a method which would enable me to load full 48K programs and then save to disk, or a program which would do the job?

James Mobberley,
Newcastle,
Staffordshire

● *This is a common problem with the Primordial Peripherals and Watford disc interfaces. You will need a special copying program from the makers.*

Functional Caps shift

ON THE Spectrum Plus, can the already Caps-shifted cursor keys be programmed to have specific functions.

Declan O'Mahoney,
County Tipperary,
Eire

● *Programmable joystick interfaces are not normally capable of respondng to shifted keys. For that reason, and to make games compatible with the old Spectrums, the unshifted 5 to 8 keys are used. Some games will also respond to shifted keys.*

Printerface incompatible

I HAVE a Spectrum and a Seikosha GP 500A printer with a Euroelectronics ZXL Print III interface.

I have no problems with general printing but it does not work on games like, **Sherlock** and **The Hobbit**. Are those programs written only for the ZX Printer?

Colin Hojern,
Hillbrow,
South Africa

● *The Euroelectronics ZXL Print III, and the Kempston E, mimic the ZX Printer in that they can print standard ASCII characters sent to channel three. Games like* **Sherlock** *and* **The Hobbit** *do a bit copy of a line of the screen in a form only the ZX Printer can understand. Those interfaces, therefore, will not work with those games.*

Another problem with **The Hobbit** *is that the standard keyboard reading routine is not used. That can cause problems if the program is used on a full-sized keyboard.*

Tasword Two troubles

I CAN'T get my Alphacom 32 Printer to work with **Tasword 2**. I have had no other problems with the printer.

Bjørn Arild Lynne,
Strommen,
Norway

● *The Alphacom 32 is a direct replacement for the ZX Printer. To print the text file go into E Mode and press P.*

Character expansion

I AM using the **Spectral Writer** word processor which accompanies the Wafadrive package.

Although a very good piece of software, it has left me with one problem. How can I alter the line length so that I can print up to 100 characters before the carriage return signal is sent.

C K Rowley,
Wolverhampton

● *The simplest way to do this, which can also be used on* **Tasword 2,** *is to go to the part of the program which allows you to set the carriage return and linefeed codes and set them to zero. Then define one of the graphics characters as line feed and place it on alternative lines.*

Another method, which is less satisfactory, is to set the right margin on the printer to 100 (on Epson machines ESC Q) and, as before, set the control codes to zero. On **Spectral Writer** *use POKE 55656,27:POKE 55662, 81:POKE 55668,100, and save the customised version. The printer will now automatically print 100 characters and then perform a line feed, which may be in the middle of a word.*

ZX membrane malfunction

SIX MONTHS ago the keys N, M and B started to work badly on my 48K Spectrum and I sent it for repair.

Now the keys don't work again, and I have been thinking of buying a full-sized keyboard to avoid any more trouble. Should I do that?

Kasper Sevaj,
Charlottenlund,
Denmark

● *The usual reason for these keys not working is that the membrane under the keyboard is broken. The cheapest source of those which I've found is from TV Services of Cambridge Ltd, Frenches Road, Cambridge CB4 3PN. Tel: 0223-311371. Price £2.50 including VAT and postage, for overseas add an extra 50p. A full-sized keyboard would also solve this problem.*

As this is the second time these keys have gone wrong it is possible that the Spectrum is at fault so it might be worth checking first.

Making the most of a Spectrum move

Animation is a difficult subject to grasp. John Gilbert makes it easy

LAST MONTH I introduced user-defined graphics, and showed how you can create 21 of your own character designs using the alternative graphics character set.

The set is stored in RAM, initially contains the capitals A to U, and can be accessed by going into graphics mode.

This month the emphasis is on using those UDGs and the line/circle commands, to produce a variety of animation effects.

Each set of commands has something different to offer, the UDGs being more suited for detailed work while the line and circle commands are fine for wide spread, full screen, effects. No matter which commands you use, however, the animation effect is produced in the same way.

First a character, dot, or line is drawn on the screen and a pause is made so that the eye can register that appearance. The pause will only occur for a fraction of a second but is important in maintaining the pace of the movement effect.

The second action comprises two parts and can be done in two ways, one of which should be used if you are working with a simple routine or fast language and the other if you want to speed the action up and do not mind a flickering image on the screen. Both actions are similar but the effects are markedly different.

Listing 1.

```
   1 REM section one. Draw/erase
/redraw
  10 FOR k=1 TO 20
  15 REM lines 20,70 and 80 prin
t the inverse space on key 8
  20 PRINT AT 0,k;"inverse space
"
  30 PAUSE 2
  40 PRINT AT 0,k;" "
  50 NEXT k
  55  REM second section. Draw/d
raw in new position/erase origin
al
  60 LET k=1
  70 PRINT AT 20,k;"inverse spac
e"
  80 PRINT AT 20,k+1;"inverse sp
ace"
  90 PRINT AT 20,k;" "
 100 LET k=k+1
 110 GO TO 70
 120 REM program will end with a
 B integer error
```

In the first, you remove the object which you have printed and redraw it in the next print position. If the switch between one position and the other is fast the impression of movement is created. The alternative method is to place a copy of the object in the new print position and only then erase the original.

There is a problem with each of those techniques. Using the first method the image will flicker because for a brief moment the image is off the screen.

The second method is similarly plagued, but for the opposite reason. When the original and new image are visible at the same time, even for a fraction of a second, your eyes will register a ghost image.

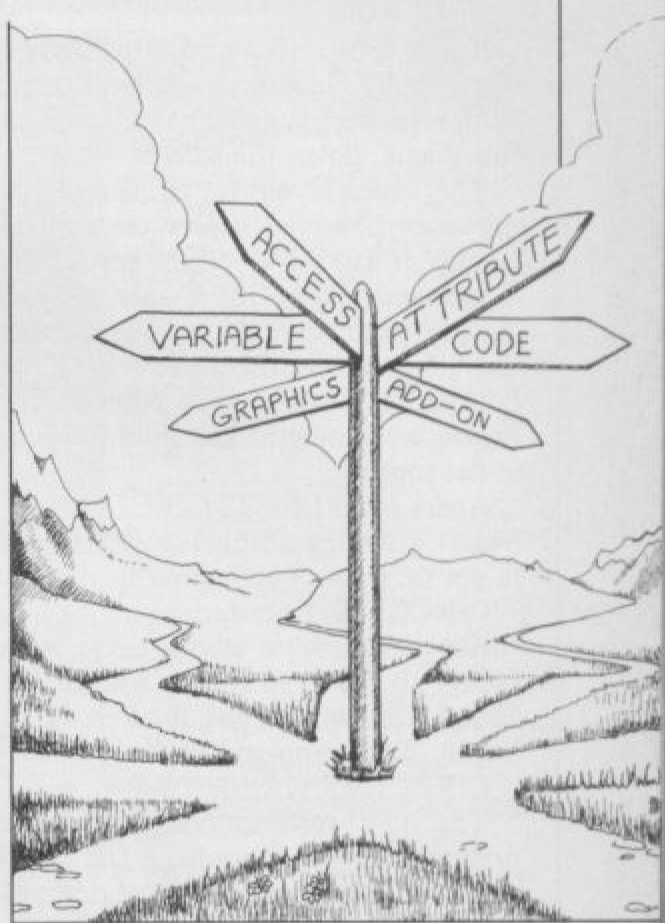
Listing one uses both techniques with a graphic block to demonstrate the difference in effect when using Basic. The first part of the program sends a block across the top of the screen using the 'take off'/'put on' technique. The block at the bottom of the screen is moved using the 'double image' method.

The technique can be adapted to bring a UDG character to life while keeping it in the same position on the screen. You may want to animate a stick man so that he walks across the screen, moving his arms and legs. In order to do that you will have to make a series of UDGs which show various stages of movement. Eight stages, or UDGs, are ideal but you could get away with four with the minimum of screen flicker.

The program would print the first stage, erase it, display the second stage one character square further on and then erase that.

Of course, the graphics do not have to be made up of one-square characters. You could put several together to form a large image and animate parts of it using the character square techniques described.

If you try animating a larger image you will see that the Spectrum has a major drawback. You must use a whole character square in animation



— you cannot use part of it. The Basic operating system has been written to deal with the screen on a character and not on a pixel level.

It is possible, however, to get away from character square animation to a limited extent by using the line, circle and arc drawing functions of Sinclair Basic.

The same techniques of drawing, erasing and redrawing an image are used but, because you are moving the image by only a few dots or pixels rather than a whole character square, the animation produced will be smoother. The image will not flicker or jump around the screen.

Listing two shows the type of effect which can be achieved using circles.

As a first step in building the sort of movement routine shown in listing two you must look at the two ways in which the Spectrum screen is divided. When printing alphanumeric charac-

continued on page 48

Listing 2.

```
   5 REM section one uses CLS
  10 FOR k=1 TO 8
  15 CLS
  20 CIRCLE 88,128,k
  30 PAUSE 1
  50 NEXT k
  60 REM section two uses OVER f
unction
  65 CIRCLE 50,50,20: REM draw p
ermanent circle
  70 FOR k=1 TO 8: REM start of
animated circle loop
  80 CIRCLE 50,50,k
  90 OVER 1
 100 CIRCLE 50,50,k
 110 OVER 0
 120 NEXT k
```

continued from page 47

ters it is split into a grid which has a width of 31 characters on the X-axis, across the screen, and 21 characters on the Y-axis, down the screen.

The screen layout for circle and line drawing, however, relies on a pixel layout. It runs 256 pixels across the X-axis and 176 up the Y-axis. As you can see from the grid in your manual the 0,0 point of the screen is at the bottom left of the screen whereas the character print grid has its 0,0 origin at the top-left.

Apart from PLOT, CIRCLE is the easiest graphics command with which to get to grips. The format is

CIRCLE X,Y, radius.

For instance, to put a circle with radius 20 pixels in the middle of the screen you would put it at X=128, Y=88. The command is

CIRCLE 88,128,20.

The key to animating any line drawn figure is to replace the X,Y, and radius values with numeric variables by which the image can be changed without having to use hundreds of separate instructions.

If you have just one image on the screen, such as a circle, you can erase it ready for redrawing by using CLS, — see the second section of listing two — but if you have several and want to animate one you will need a new approach and a new function.

The Sinclair Basic OVER function allows a programmer to draw another image on top of an existing one. You may want to draw a moving object which does not wipe out background as it moves. OVER can also be used to erase a drawing just by redrawing the redundant figure again. The second section of listing two, although slow due to Sinclair Basic, demonstrates this clever use of OVER.

The main Entry Program, listing three, demonstrates many of the techniques explained in this article. It creates and animates a line of space invader creatures.

Next month I will be creating a keyboard joystick to directly control an animated character, and looking at the ways in which you can manipulate the Spectrum attribute file to speed up animation and create new colours.

Listing 3. Space invader animation.

```
  10 FOR k=0 TO 7
  20 READ a
  30 POKE USR "P"+k,a
  40 NEXT k
  50 FOR k=1 TO 7
  60 READ a
  70 POKE USR "Q"+k,a
  80 NEXT k
  90 DATA 28,62,42,255,62,28,66,
129
 100 DATA 28,62,42,255,62,28,36,
24
 200 FOR k=1 TO 10
 210 PRINT AT 10,10;"P   P   P
P   P"
 220 PAUSE 20
 230 CLS
 240 PRINT AT 10,10;"   Q   Q
Q   Q   Q"
 250 PAUSE 20
 260 CLS
 270 NEXT k
```

Lines 10-100 set up the two UDGs which are necessary to animate the character. Information about the underlined graphics characters can be found on the first page of Program Printout.
Line 200 sets up a loop which will execute the animation sequence 10 times.
Line 210 prints out the first position and aspect of the invader character. Its legs are outstretched. The line uses graphics 'P' and there are three spaces between each 'P'.
Line 220 ensures that the eye of the viewer has time to register the first aspect. Change the value of PAUSE to speed up or slow down character movement.
Line 230 erases the first image and line 240 prints up the second image displaced by three spaces along the X-axis. The character now has its legs tucked under its body.
Line 250 introduces another short pause before line 260 erases the image and line 270 takes you back to line 200 and another run over the sequence.

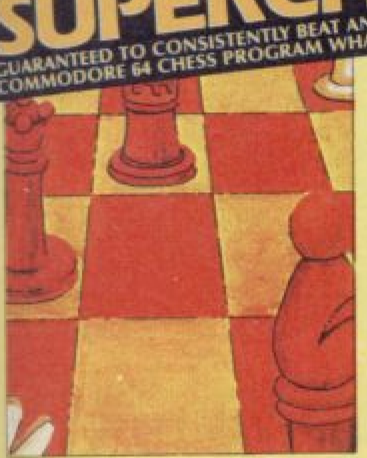
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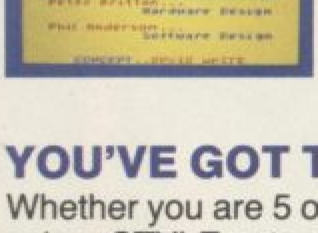
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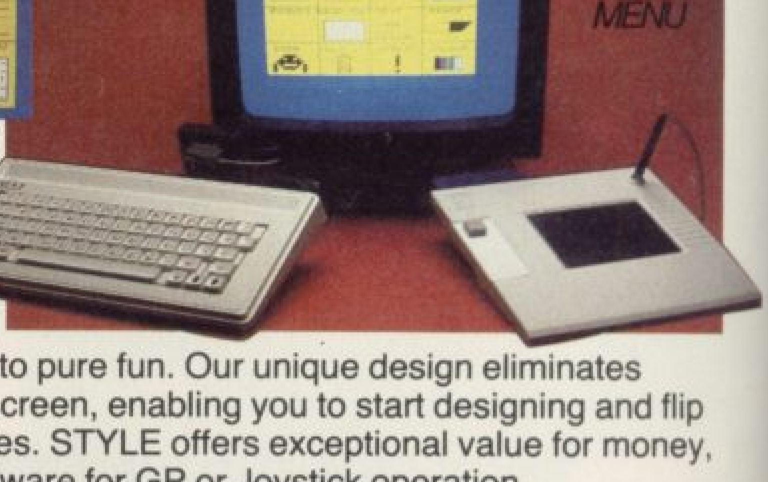




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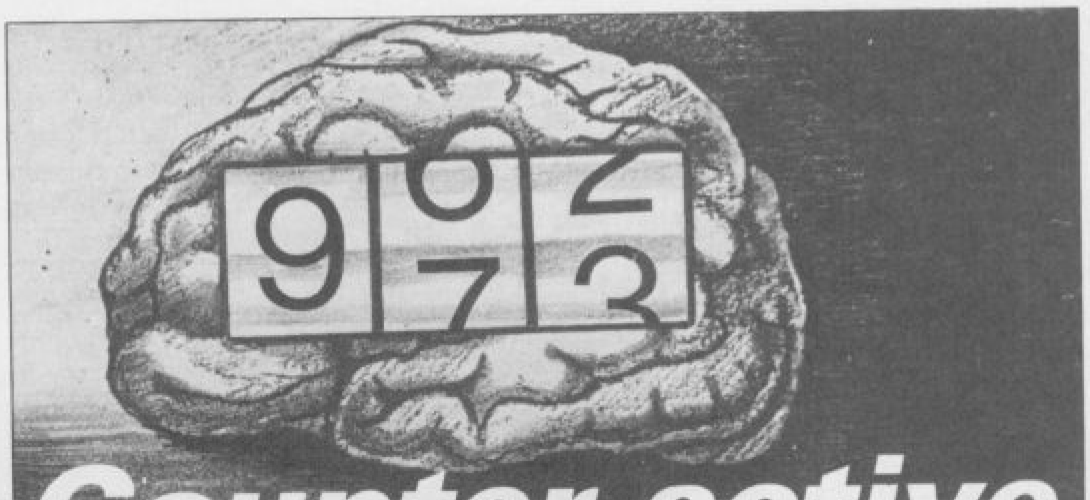
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Counter active

Continuing his look at Z80 operations Marcus Jeffery loops the loop

NOT HAVING the structure available in many languages, such as Pascal, machine code programs rely on the use of jump statements. Those are akin to the Basic GOTO command. A typical machine code jump might look like

```
EA60 3E01 LD A,1
EA62 C360EA JP EA60
```

which would load the accumulator with the value one, then jump to location EA60 (hex) to repeat the instruction.

When using machine code, we usually use an assembler, and those allow the use of labels to make jumps clearer. You will have seen those before in the mnemonic listings, and a number of labels can be seen in figure two. The above loop could thus be

```
EA60 3E01 LABEL LD A,1
EA62 C3EA60 JP LABEL
```

That of course is an infinite loop, and does not allow an exit. The Basic equivalent would be

```
10 LET A = 1 : GOTO 10
```

A very similar instruction to JP is JR – Jump Relative. When using JP, the program always jumps to the specified location. With JR, however, the program jumps to a location relative to your present location. The example above using JR would be

```
EA60 3E01 LABEL LD A,1
EA62 18FC JR LABEL
```

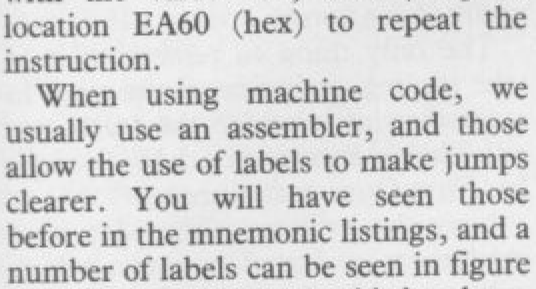


Figure 1. Flag register

which would jump to the location EA64 – the start of the next instruction – minus four – giving EA60.

The JR instruction has the advantage of being one byte shorter – two bytes instead of three — but that implies that you cannot use it to jump any great distance. The displacement byte is assumed to be PLUS – forward – if it is less than 80h and MINUS – backwards – if greater than 7Fh. In the latter case, the value is calculated as 100h (256) minus the value given.

We can check this with

Fch = 252
256−252 = −4
EA64h−4 = EA60h

That means that we have a range of

00h-7Fh (0 to 127)
and FFh-80h (−1 to −128)

The other advantage of using JR, rather than JP, is that it is relocatable. We will be discussing this in a later article, but essentially it implies that the actual address is not used.

Of course, just as in Basic, jumps are not much use on their own. Their real power is only realised when they are combined with conditions. Z80 machine code does not have the flexibility of Basic when testing for conditions.

All testing is carried out on the hitherto unused F (Flag) register. The individual bits of this register are used as shown in figure one. The values of the bits in the register are set based on the last operation, so they can then be tested using special instructions.

All the jump instructions are shown in figure six, but here is a typical example, showing how to form a loop

```
        .
        .
        .
        LD HL,1
LOOP    ADD HL,HL
        DEC A
        JR NZ,LOOP
        .
        .
        .
```

The HL registers are initially loaded with the value of one. The ADD instruction effectively multiplies HL by two. The value of A is then decremented, and if Not Zero (NZ) a relative jump is made, otherwise the code continues. This small piece of code has the effect of placing the value of 2^A into HL, assuming that A is greater than zero and not too large to cause HL to overflow.

Special instructions are also provided whose only job is to set flags in the F register. Those are the compare instructions – see figure six. In the counter program we use.

CP 8Ah

That subtracts the data (8Ah) from whatever value is currently in the accumulator. The flags are set, but the value of the accumulator is left unchanged. The next instruction is

JR NZ,CHANGE

which will now jump to the label CHANGE if the contents of the accumulator are not 8Ah – that is Acc−8Ah <> 0.

One final test instruction which we will look at is BIT. That can be used to test individual bits of a particular register or location. In our program

BIT 7,A

tests to see if the most significant bit – the top bit, counting from bit 0 left to right – in the accumulator is set. If the specified bit is set – in other words, is a '1' – then Z (Zero) in the Flag register will be False. That may seem complex at first, because the complement of the specified bit is placed into the Z flag. Have a look at the program to see how this works.

Other bit instructions which you may come across are SET and RES, which place a '1' or '0' respectively into a specified bit. Variations of this instruction are shown in figure six.

We have seen how to implement a loop using a conditional jump instruction. Z80 also has a specified abbreviated loop instruction called DJNZ. This stands for 'Decrement the B register and Jump to a given label if Not Zero'.

So, if we wanted to improve the example above, by using the B register instead of A, we could write

:
.

continued on page 54

continued from page 53

```
          LD HL,1
LOOP      ADD HL,HL
          DJNZ LOOP
          .
          .
          .
```

There is one last set of instructions to look at before we deal with this month's program. Those are the 'stack' operations. When using machine code, it's very easy to run out of registers to use. One way of dealing with that is to save the register to a spare location, use the register for another task, then reload it from the location.

There are a number of disadvantages with this method, and it is such a common problem that there are a number of special instructions to deal with it. Those are called PUSH and POP. A stack can be thought of as a pile of plates. If a plate is PUSHed onto the top of the pile, then it must also be the first removed – POPped.

Registers may be pushed onto the stack in pairs – A+F, B+C, D+E and H+L – and popped from the stack in the same way. A pointer to use the top of the stack, surprisingly known as the stack pointer (SP), is automatically updated for you.

The only thing to remember is to take the register pairs off the stack in reverse order to which they were put on. This is known as a LIFO – Last In, First Out – structure.

Now the program. The idea is to implement a digital counter, which will automatically update its value by one whenever it is called, and display the new value on the screen.

```
                              ORG   60000
                              LOAD  60000
EA60 21BCEA                   LD    HL,NMBRS     ;HL = start of digits
EA63 3E80        OVFLOW       LD    A,80H        ;set top bit in A
EA65 86                       ADD   A,(HL)       ;add previous digit
EA66 3C                       INC   A            ;     and update it
EA67 77                       LD    (HL),A       ;replace digit in memory
EA68 FE8A                     CP    8AH          ;has it reached 10?
EA6A 2005                     JR    NZ,CHANGE    ;go on if not, else
EA6C 3680                     LD    (HL),80H     ;reset digit to zero
EA6E 23                       INC   HL           ;increment to next digit
EA6F 18F2                     JR    OVFLOW       ;go back for next digit

EA71 21C1EA      CHANGE       LD    HL,DSPLY
EA74 2B                       DEC   HL           ;zero overflow digit
EA75 3600                     LD    (HL),0
EA77 0608                     LD    B,8          ;B counts 8 shifts
EA79 21BCEA      NSHIFT       LD    HL,NMBRS     ;HL point to digits
EA7C ED5BC1EA                 LD    DE,(DSPLY)   ;DE = bottom right of display
EA80 7E          NDIGIT       LD    A,(HL)       ;get digit in A
EA81 CB7F                     BIT   7,A          ;is top bit set?
EA83 2824                     JR    Z,ESHIFT     ;jump to finish if not
EA85 D5                       PUSH  DE
EA86 E5                       PUSH  HL           ;stack registers
EA87 F5                       PUSH  AF
EA88 62                       LD    H,D
EA89 6B                       LD    L,E          ;HL = Display line above DE
EA8A 25                       DEC   H
EA8B 0E07                     LD    C,7          ;C counts 7 shifts
EA8D 7E          SCROLL       LD    A,(HL)       ;move a byte to the
EA8E 12                       LD    (DE),A       ;     line below
EA8F 15                       DEC   D            ;move HL & DE pointers
EA90 25                       DEC   H            ;     up by one line
EA91 0D                       DEC   C
EA92 20F9                     JR    NZ,SCROLL    ;repeat 7 times
EA94 F1                       POP   AF           ;restore AF register
EA95 CB27                     SLA   A
EA97 CB27                     SLA   A            multiply A by 8
EA99 CB27                     SLA   A
EA9B 80                       ADD   B            ;add shift count
EA9C C680                     ADD   A,80H        ;add lsb loc "0"
EA9E 6F                       LD    L,A
EA9F 263D                     LD    H,3DH        ;HL = 3D80H+8*digit+shift
EAA1 7E                       LD    A,(HL)
EAA2 12                       LD    (DE),A       ;display appropriate byte
EAA3 E1                       POP   HL           ;restore digits to HL
EAA4 23                       INC   HL           ;move to next digit
EAA5 D1                       POP   DE           ;restore display position
EAA6 1B                       DEC   DE           ;previous display position
EAA7 18D7                     JR    NDIGIT       ;do next digit
EAA9 1E01        ESHIFT       LD    E,1
EAAB 76          DELAY        HALT               ;delay to give user time
EAAC 1D                       DEC   E            ;to see the scrolling
EAAD 20FC                     JR    NZ,DELAY
EAAF 10C8                     DJNZ  NZSHIFT      ;repeat eight times

EAB1 21BCEA                   LD    HL,NMBRS     ;HL = Start of digit data
EAB4 0604                     LD    B,4          ;there are four digits
EAB6 CBBE        RESBIT       RES   7,(HL)       ;top (changed) bit = 0
EAB8 23                       INC   HL           ;next digit
EAB9 10FB                     DJNZ  RESBIT
EABB C9                       RET

EABC 09090909
EAC0 00          NMBRS        DB    9,9,9,9,0
EAC1 714F        DSPLY        DB    71H,4FH
                              END

Workarea   - A692 to A82B
ORG end    - EAC3
LOAD end   - EA60
```

Figure 2. Assembly code

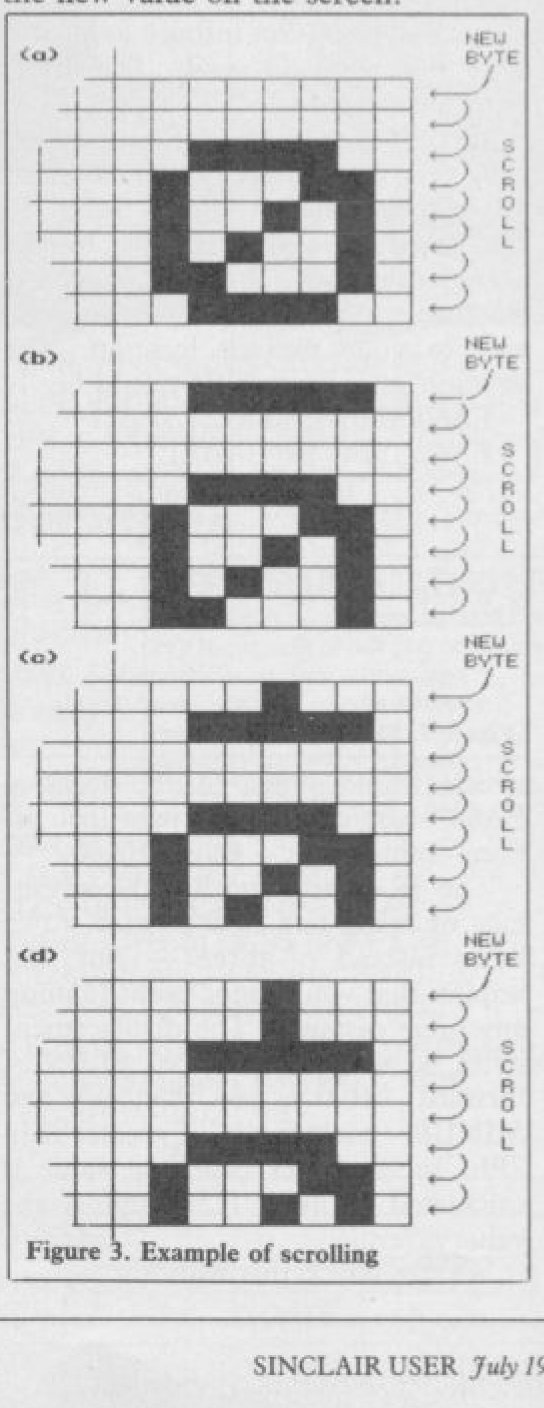


Figure 3. Example of scrolling

The clever bit is to ensure that this update is shown graphically as rotating digits, just like the real digital display. The assembly code for this – figure two – can be divided into three distinct stages

EA60-EA76 which adds one to the four-digit counter.

EA77-EAB0 which does the on-screen scrolling.

EAB1-EABB which resets, ready for the next call.

The comments should enable you to follow the program, but here are a few points. When incrementing the four digits – each held in one byte, including a fifth overflow byte – the top bit of the digit is set if it has changed. That is the reason for the test 8Ah (Top Bit + 10).

Figure three should give some indication of how the scrolling works. The code from EA88 to EA94 scrolls the necessary characters down by seven pixel lines, and the code to EAA2 finds the value of the next byte to be placed on the screen from the Spectrum character set. The four instructions from ESHIFT create a delay loop, to give you time to see the display. To halve the speed of the scrolling, increase the number loaded into E, at ESHIFT, by one.

Finally, the two numbers held in location EAC1 and EAC2 – label DSPLY – are the bottom-right screen address of the four bytes displayed. Figure four gives a list of the values you can place in here to move the counter on the screen.

Figure five gives a Basic loader program and example calling routine.

```
4703 4704 4705 . . . . 471E 471F
4723 4724 4725 . . . . 473E 473F
  .    .    .     .    .    .
47C3 47C4 47C5 . . . . 47DE 47DF
47E3 47E4 47E5 . . . . 47FE 47FF
---------------------------------
4F03 4F04 4F05 . . . . 4F1E 4F1F
4FE3 4FE4 4FE5 . . . . 4FFE 4FFF
---------------------------------
5703 5704 5705 . . . . 571E 571F
57E3 57E4 57E5 . . . . 57FE 57FF
```

Figure 4. Screen display locations (hex)

You will notice that lines 40 to 70 use our special abbreviations for graphics characters, so please read the instructions on the first page of Program Printout.

You might like to change the program. First of all, to make the program count downwards, rather than up, change the following

Line 2010:	3C	to 3D
	FE8A	to FE7F
Line 2020:	3680	to 3689
Line 2170:	0909090909	to 0000000000
Line 2180:	00	to 09

This will then count down from 9999. Note that all the digits change when the routine is first called, ensuring that all the digits are displayed.

If you would like to count from a different number, simply change the start digits at the end of line 2170, and print the start number in line 70, instead of the four spaces. The INK statement in line 70 also specifies the colour of the digits.

It is quite a simple matter to modify the code to work with more than four digits. To add a fifth digit, change the start number (line 2170) to a five-digit figure. You must also change the address of the display location – presently EAC1. So alter the C1EA to read C2EA in lines 2030 and 2050.

```
  10 CLEAR 59999
  20 GO SUB 1000
  30 CLS
  40 INK 2: PRINT AT 10.13:"(ig4
:4*g3:g7)"
  50 PRINT AT 11.13:"(ig5:4*sp:g
5)"
  60 PRINT AT 12.13:"(ig1:4*ig3:
ig2)"
  70 INK 1: PRINT AT 11.14:"(4*s
p)"
  80 RANDOMIZE USR 60000
  90 GO TO 80
 100 STOP
1000 REM HEX LOAD ROUTINE
1010 DEF FN p(x)=CODE h$(x)-48-7
*(CODE h$(x)>=65)
1020 LET byte=0
1030 RESTORE 2000
1040 READ start
1050 READ h$
1060 IF h$="*" THEN  GO TO 1160
1070 IF LEN h$<>2*INT (LEN h$/2)
 THEN  PRINT "Odd number of hex
digits in: ";h$: STOP
1080 FOR i=1 TO LEN h$
1090 IF NOT ((h$(i)>="0" AND h$(
i)<="9") OR (h$(i)>="A" AND h$(i
)<="F")) THEN  PRINT  "Illegal h
ex digit: ";h$(i): STOP
1100 NEXT i
1110 FOR i=1 TO LEN h$ STEP 2
1120 POKE start+byte,16*FN p(i)+
FN p(i+1)
1130 LET byte=byte+1
1140 NEXT i
1150 GO TO 1050
1160 PRINT "Code entered"
1170 PAUSE 150
1180 RETURN
2000 DATA 60000,"21BCEA","3E80"
2010 DATA "86","3C","77","FE8A"
2020 DATA "2005","3680","23"
2030 DATA "18F2","21C1EA","2B"
2040 DATA "3600","0608","21BCEA"
2050 DATA "ED5BC1EA","7E","CB7F"
2060 DATA "2824","D5","E5","F5"
2070 DATA "62","6B","25","0E07"
2080 DATA "7E","12","15","25"
2090 DATA "0D","20F9","F1"
2100 DATA "CB27","CB27","CB27"
2110 DATA "80","C680","6F"
2120 DATA "263D","7E","12","E1"
2130 DATA "23","D1","1B","18D7"
2140 DATA "1E01","76","1D"
2150 DATA "20FC","10C8","21BCEA"
2160 DATA "0604","CBBE","23"
2170 DATA "10FB","C9","09090909"
2180 DATA "00","714F","*"
```

Figure 5. Basic program

JP	address	– jump to address.
JP	cond,address	– jump to address if condition is true. where condition is: NZ – Non-Zero; Z – Zero; NC – No Carry; C – Carry; PO – Parity Odd; PE – Parity Even; P – Positive; M – Negative
JP	(HL)	– jump to the address specified by the HL register pair.
JR	offset	– jump to present address plus offset.
JR	cond,offset	– jump to present address plus offset if the condition is true, with condition: NZ – Non-Zero; Z – Zero; NC – No Carry; C – Carry
CP	data	– set flags for result of Accumulator minus data.
CP	reg	– set flags for result of Accumulator minus register.
CP	(HL)	– set flags for result of Accumulator minus the contents of the location held in the HL register pair.
BIT	bit,reg	– test specified bit in register.
BIT	bit,(HL)	– test specified bit in contents of location addressed by HL register pair.
SET	bit,reg	– set specified bit in register.
SET	bit,(HL)	– set specified bit in contents of location addressed by HL register pair.
RES	bit,reg	– reset specified bit in register.
RES	bit,(HL)	– reset specified bit in contents of location adressed by HL register pair.
DJNZ	offset	– decrement the B register. If the contents are NOT ZERO, then jump to present address plus offset.
PUSH	rp	– write register pair to top of stack (rp = AF, BC, DE or HL).
POP	rp	– read register pair from top of stack (rp = AF, BC, DE or HL).

Figure 6. New Z80 instruction codes



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There were Steve Cain and Ally Noble and Karen Davies, the artists.

There was Kenny Everrett, no relation.

And there was a character at the top, where all the hype and the Ferraris and the duff cheques whirled about in a dust storm of vituperation and desperate attempts to keep going just another month, just another week, and his name was Dave Lawson.

"Do you want to know what the brief was for **Bandersnatch**?" asks Steve Cain. He's going to tell us anyway. "Dave Lawson came to us and said 'You've got four weeks to produce the best game graphics the world has ever seen'. That was all. We took four months and it still wasn't finished."

Then Imagine went bust, and the **Bandersnatch** team was out of a job, along with dozens of others who gave their soul for the most spectacular, romantic and, ultimately, sordid software company this country is ever likely to see. Dave Lawson and Ian Hetherington, both directors, wanted to keep the **Bandersnatch** team. They said they could get money in America.

Steve and Ian Weatherburn thought differently. "They told us the market in the UK was dead, you wouldn't get more than £5000 for a game tops, even if it was a number one."

They made a few phone calls and soon found out that the market was very much alive. "We talked to Bill Delaney at Beyond Software for half an hour and after that we were Beyond's men."

The idea was that Steve and Ian would set up a new company, Denton Designs, to write games for other software houses. For Steve, the attraction of Beyond had a lot to do with their products. "They had **Lords of Midnight**. Sometimes you see things by other people and you say 'I wish I'd done that'. Well, we thought we could produce things like that without having people of the calibre of Bruce Everiss around to cock it up for us."

Steve was anxious to include the other members of the team in the new deals. He'd been to college with Ally and Karen, and didn't want to see his friends sink without trace. The trouble was that most of them still wanted to believe in Dave Lawson. Then John and Kenny were served with writs along with Steve, so they joined up. After that, Ally and Karen came in.

"Beyond agreed to take two games from us, fund our development and premises. They wanted us badly but weren't prepared to take an almighty risk." Meanwhile Ocean was getting in on the act. The Denton team was turning into a hot property.

"All of a sudden up pops Steve Blower. He used to be at Imagine too, but he joined Ocean. Had we finished **Bandersnatch**? As far as we were concerned we were tied up with Beyond, and **Bandersnatch** would never see the light of day. But we met Ward, nevertheless."

David Ward, chairman of Ocean, told them not to worry about **Bandersnatch.** "Write a different game," he said. "Write one for me and I'll give you a contract for three and buy your old equipment from the receiver at Imagine." So Denton Designs signed up with Ocean as well and wrote **Gift from the Gods**. "It did OK, about 25,000 copies," says Steve. The game was designed in the main by John Gibson, and featured a large animated figure of the Greek hero Orestes searching a vast labyrinth for his sister Electra.


The many faces of Denton: Ally Noble, John Heap, Dave

Denton Designs was split six ways between the original team, with everybody having an equal share. But Ian Weatherburn was unhappy. "For Ian, Imagine was heaven on earth," says Steve. "He wanted Denton to be just like Imagine. When we signed the contract to do **Shadowfire**, Ian said we had to do it his way or he would leave. So we sacked him. Actually, he's now working for Ocean."

Shadowfire, which we tipped as a *Sinclair User* Classic last month, is the most impressive piece of software so far programmed by Denton Designs. An icon-based adventure, it dispenses with text and uses menus full of pictures of objects. You move a cursor around these pictures, or icons, to



..., Dave Colclough, John Gibson, Steve Cain, Karen Davies.

shouldn't but we had to." Contract work demands it — you cannot afford to turn people down. If you haven't got enough programmers you have to hire some more. That's the theory, anyway.

Certainly Denton has been in demand. Apart from **Gift from the Gods** and **Shadowfire**, the list of credits includes **World Series Baseball** for Imagine 84, **Spyhunter** for US Gold, and, yet to be released, **Roland Rat** and **Frankie goes to Hollywood** for Ocean, **Shadowfire II** and **Bouncers** for Beyond, plus, no doubt, more secret projects.

The games fall into two categories. There's conversion work, like **Spyhunter** and **Roland Rat**, and there's Denton's own which seem to be considerably superior. The Frankie game, for example, is Denton's own work,

"Writing software is as creative as writing a song. We need to appeal to people of all ages"

and quite superb. "Frankie was designed by four non-games-playing people and that could prove to be really good," says Steve.

John Gibson, Kenny Everritt, Ally Noble and Karen Davis are the lucky quartet. Lest you find the naming of names boring, know that Steve and his pals are saddened by the lack of recognition given to the programmers and artists. "These days when you pick up a paper it shouldn't be 'Bill Delaney of Beyond says . . .'. It should be 'Mike Singleton says . . .'." It's a fair point; Mike wrote **Lords of Midnight**, and he's a freelance.

"It works because we're all close friends," says John Gibson, taking a brief break from his labours on Frankie. "We argue a lot and call each other names but we're still friends. If my games lack anything I suppose they lack gamesmanship."

"Your games don't lack anything at all," soothes Karen.

"No, it winds me up sometimes," says John. "A game like Elite's **Airwolf** gets slagged off by all the reviewers but gets to number two in the charts. Other games with rave reviews

continued on page 60

choose your action or movement.

The game is very much Denton's, although published by Beyond. "Beyond has never pressed us on a game, although they do test it, and say whether it has appeal," says Steve. "If we had a game and both Beyond and Ocean didn't like it we would respect that. They have a pretty good track record.

"On the Commodore 64 **Shadowfire** there was a bug. A phantom would appear and attack members of the Enigma team. We couldn't work out why, so we decided it was Zoff's pet. It turned out there was a spelling mistake on a single mnemonic in the machine code somewhere. We've taken the bug out now, so the bit in the booklet about Zoff's pet doesn't matter any more."

Gift from the Gods was a direct descendant of **Bandersnatch**, in that it had a large animated figure wandering through the screens. But the icon system on **Shadowfire** was new. Ian Weatherburn conceived the idea of an icon-driven adventure back in the Imagine days, but nothing was ever done about it. Denton sees the icon system as something on which a whole range of products could be based.

"After Christmas we may change direction and move away from games," ruminated Steve. "The icons could be used to produce a library of routines for education software, and maybe special software for magazines and the like."

Commodore freak Dave Colclough joined Denton after Ian left, and more programmers have come in since. They are mostly ex-Imagine people — from Thor, set up by Imagine director Mark Butler, or Concept, a similar outfit to Denton but responsible for the Argus Mind Games series. A sense of déjà vu creeps in. Wasn't it this that went wrong at Imagine — growing too fast?

"We had to expand or go bust," says Steve, simply. "People say we

continued from page 59

don't sell at all." Haven't the distributors and retailers got something to do with that? "Smiths and Boots are important, yes. I strongly object to people like Boots who say they won't stock a game because the box won't fit on their shelves."

If anything has crossed over from Imagine, it's the sense that programmers are creative people, artists in their own right, and that software is part of the entertainment industry. "It's just as creative as writing a song," says Steve. "I'm talking from experience." Mind you, Steve Cain never made any money out of his songs.

"I'd like to see designers and programmers seen as creative people. Software is too much regarded as a toy. The vital statistics of the end user are changing." What? They're getting fatter? "No, they're getting older. We need to appeal to people of all ages, instead of just producing masses and masses of arcade-type games. Mind you, it's probably about time for an old-style shoot-em-up."

Games design does not come easily, according to Steve. The idea of having a team of characters in **Shadowfire**, the Enigma team, was so the player would identify with at least one. "Karen insisted the game needed a female character so we invented Sevrina," explains Steve.

The desire to include female characters and the like opens up some of the moral questions about games. Does Denton Designs have strong feelings about the sort of games they write — particularly since the programs are written for other companies? After all, the company has worked for US Gold



in the past, who brought out **Raid over Moscow**, criticised for its political overtones.

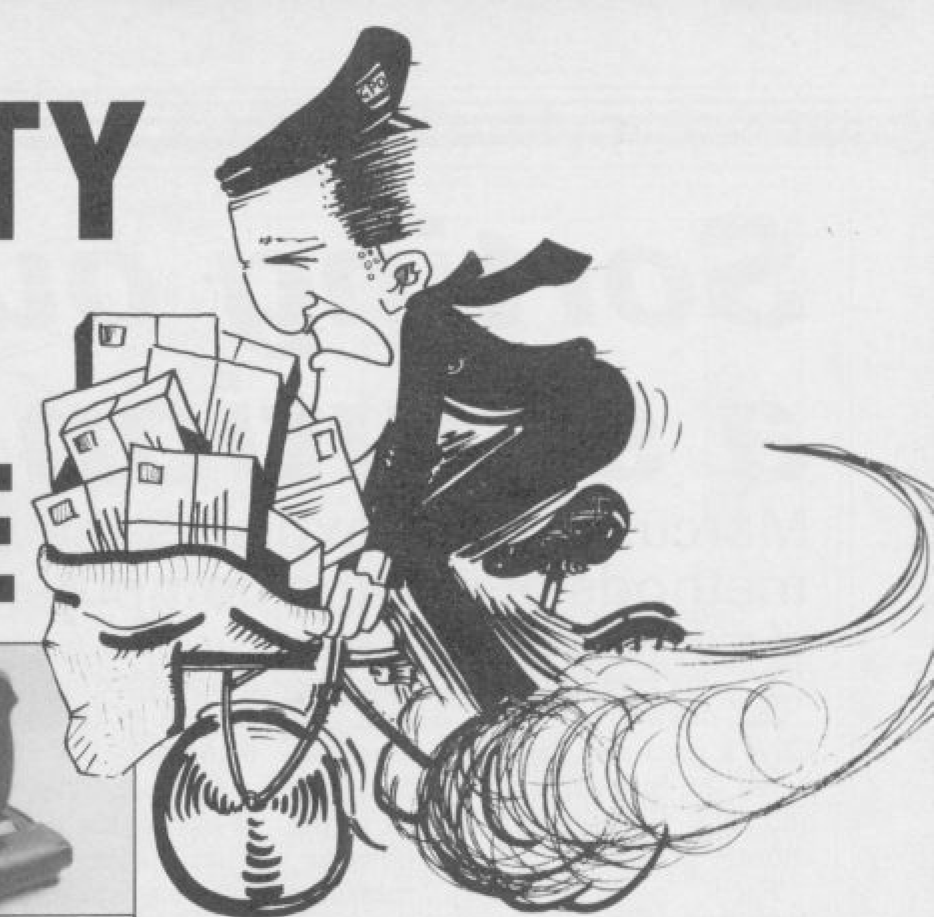
"We wouldn't see that sort of thing as a game idea in the first place," says Steve after much reflection. "There are definitely some people here who would feel unhappy about it, although I have no strong feelings myself."

Violence in itself however is not an objection. Christmas will see the launch of **Bouncer**, which is what Denton is calling a new game for Beyond on its Monolith label. "The game has gladiators of the future trying to propel a metal ball to a goal. There are eight character types to choose from and you can play against an opponent."

The success of Denton in a short space of time has much to do with the relaxed, enthusiastic attitude of the team. It is also a benefit not to have to worry about advertising, duplication, packaging, distribution and all the other expensive aspects of producing games which so often bankrupt software houses. Are we seeing the birth of a new type of progamming house, where publishers seek out the creative team they require for particular projects? Steve is quite convinced of the rightness of Denton's approach.

"It will be more important to our clients to have our names on the box than theirs," he says, confidently. At Imagine they tried to conquer the universe, and failed. Today they'll be happy with a decent slice of the market — and seem set to capture a lot more.

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Sorting out a solution

Marcus Jeffery explains the various methods of solving computer problems



YOU ARE a smuggler. A nameless East European country has discovered the delight of Clive's machines, and you have cornered the black market in Spectrums and QLs. Smuggling them out of the country presents a problem, however.

Each packing case measures 3′6″×3′6″×3′6″ as in figure one, and each Spectrum box measures 1′6″×1′×6″. The size of the QL boxes is 2′×1′×6″. The profit on a Spectrum is £40, and on a QL, £70.

You want to make as much money as possible, but how do you fit the computers into the cases? Looking at the profits the QL would appear to be the best bet. The Spectrum computers are 75 percent of the volume of the

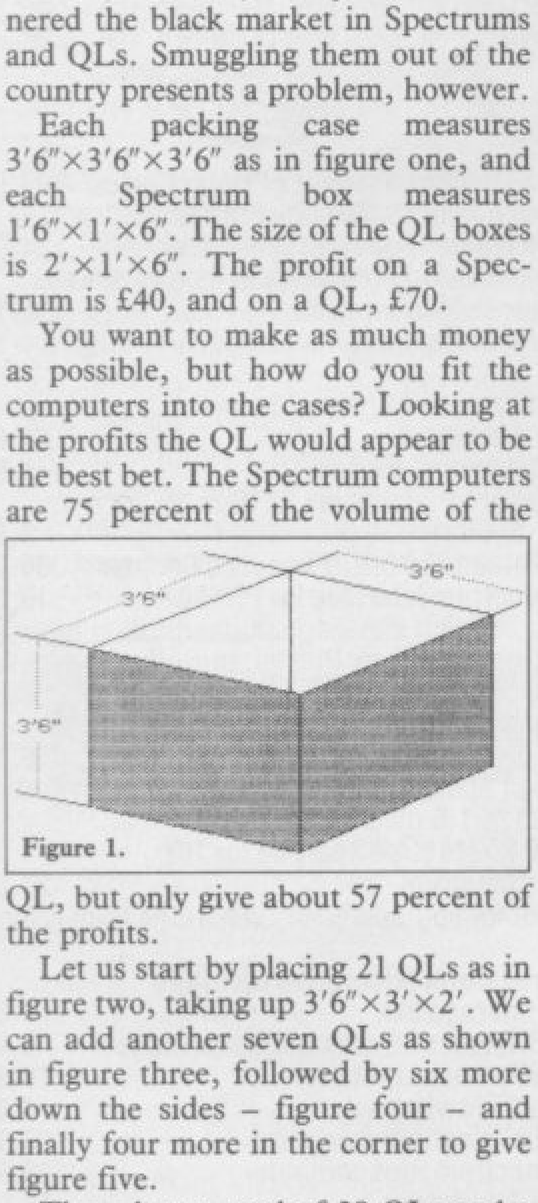


Figure 1.

QL, but only give about 57 percent of the profits.

Let us start by placing 21 QLs as in figure two, taking up 3′6″×3′×2′. We can add another seven QLs as shown in figure three, followed by six more down the sides – figure four – and finally four more in the corner to give figure five.

That gives a total of 38 QLs and a profit of £2660 per box. Not bad, but we can improve things by utilising the extra space. First of all, by removing one of the boxes marked 'X' in figure five we can fit in three Spectrums for a profit of £120 rather than £70. We can also fit a Spectrum in on top.

In addition, if we remove the top two boxes of the six which we fitted in figure four, then we can add a further six Spectrums. So, by removing three QLs and adding 10 Spectrums, our profit is now

(35×£70)+(10×£40)=£2850

Is this the best we can do? There is a little space left, but certainly not enough to fit another computer into, being only 1′6″×6″×6″.

Consequently, we can be fairly sure of having the tightest fit possible, but what happens if we have lots of different box sizes? How do we work out the optimum fit for everything, other than by trial-and-error?

The only sure way would be to try every possible combination, starting with either a QL or Spectrum in one corner, then adding a computer next to it – in all possible orientations – and so on. This is going to take even the fastest of computers a while to solve.

So far, we have been looking at a fairly complex 3D approach. A 2D version of this is a common problem known as 'bin-packing'. The problem concerns a rectangle with a given width, but unlimited height. This is the bin, and the object of the exercise is to pack a number of smaller rectangles inside, in such a way that they have as small a height as possible.

Figure six shows how nine such rectangles might be fitted into a bin. The rectangles are in the form of a list – numbered one to nine – and they are

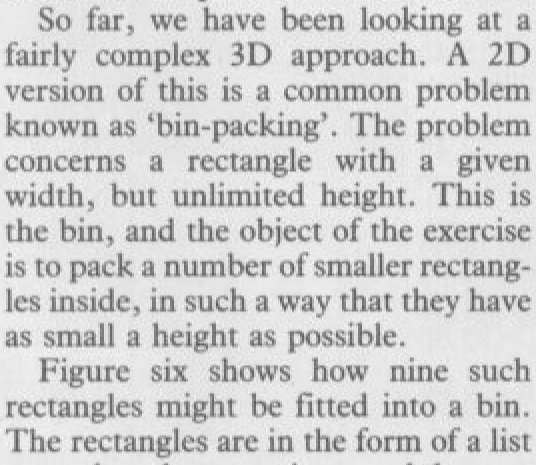


Figure 2.

placed into the bin as they occur in the list. Each time a rectangle is packed, it is placed as near to the bottom left-hand corner as possible. As can be seen from this example, the packing is not particularly efficient.

If the list of rectangles is ordered into decreasing height, as in figure seven, then the overall height is less.

Much research has discovered a bewildering variety of ordering for the list, and methods of placing the rectangles. For instance, the 'bottom left' approach with a list ordered into decreasing height as taken in figure seven, will have a total height of three times the optimum height with the worst possible list of rectangles. Another method is 'non-increasing size'. In the example given, that would give an optimum result, but you can try a few methods out with your own data.

So, what's the use of it all? Apart from obvious applications, such as cutting shapes out of sheet metal, there is also a computer-related problem. Imagine that the width of the bin is a large computer's available memory, and the height is time. Each computer job can be viewed as a rectangle with the height and width being the time and memory required.

The bin-packing problem is now the problem of running a queue (list) of jobs (rectangles) in the shortest possible time (height). Of course, the computer could try all possible combinations of fitting the jobs into memory, as we suggested.

Unfortunately, assuming there are a reasonable number of jobs, the computer is likely to spend so much time calculating the optimum fit that it will never have time to run the jobs.

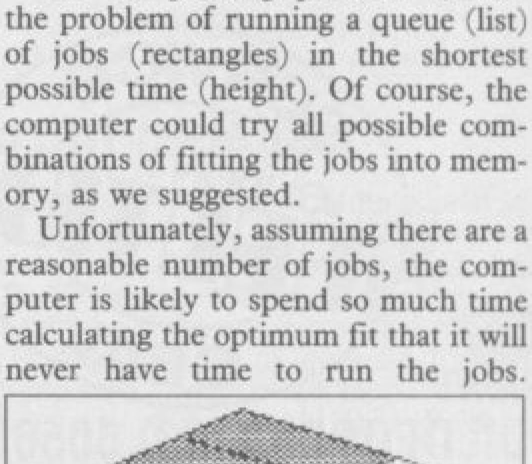


Figure 3.

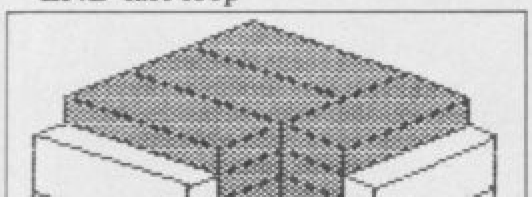


Consequently, the scheduling problem is solved by initially sorting the list of jobs into a particular order.

We have seen how taking different approaches to problems can greatly affect the time it takes to complete a particular algorithm. The same applies to many problems, including general computer sorting techniques.

The most common sort routine, which the majority of people would implement due to its simplicity, is known as a 'bubble sort'. A pseudo-english algorithm for this would be something like

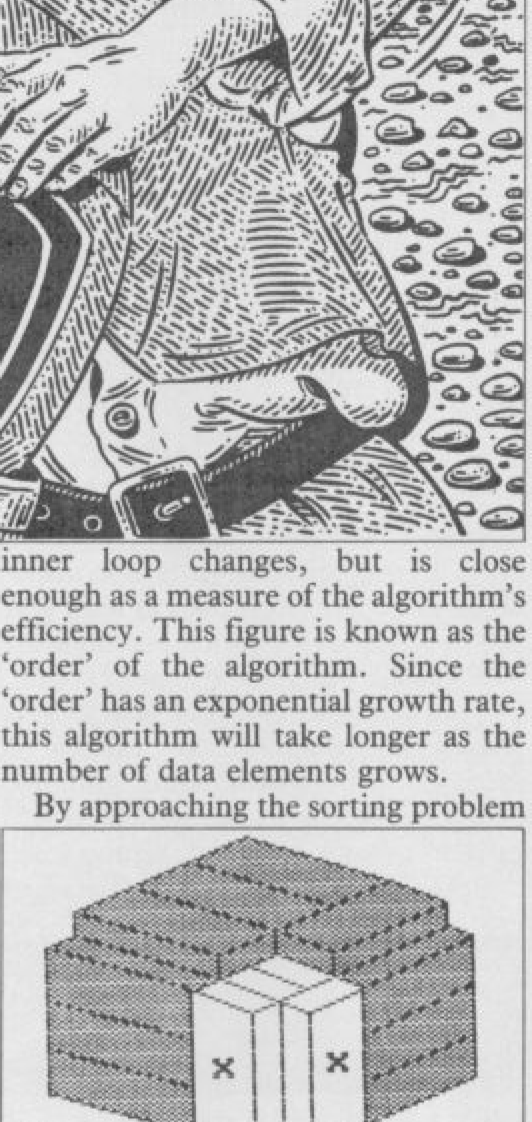
FOR last = N DOWNTO 2
FOR I = 1 TO last
IF Ith element › I+1th element, then swap them
END I loop
END last loop


Figure 4.

where 'N' is the number of elements to be sorted. This routine can be seen working on the integers one to eight in figure eight. With each iteration, the largest number not yet placed filters through to its final position – black boxes.

This routine takes too long for large amounts of data. The approximate number of comparisons necessary is N^2 (N times N). This is not strictly true, because the 'last' value of the inner loop changes, but is close enough as a measure of the algorithm's efficiency. This figure is known as the 'order' of the algorithm. Since the 'order' has an exponential growth rate, this algorithm will take longer as the number of data elements grows.

By approaching the sorting problem


Figure 5.

with a completely different method, the time can be greatly improved. Mergesort works by splitting the elements to be sorted into two halves, of approximately equal length, which it then sorts separately, and finally 'merges' together.

Of course, each of those half lists can in turn be sorted using mergesort, by dividing them further, and so on. Figure nine gives a better indication of how this algorithm would deal with the list of numbers one to eight. Mergesort has the advantage of having an order of $N \log_2 N$, even if the data is ordered in the worst possible way.

There are numerous other sorting algorithms which can sometimes do better than mergesort, but the order of the mergesort cannot be beaten in the worst case. For example, a well-known sorting routine called quicksort tends to work marginally quicker than mergesort on random data. However, if the data is ordered in the

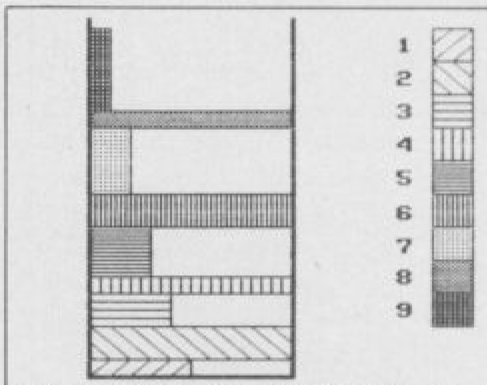


Figure 6. Unordered list of rectangles

worst possible way, then quicksort is no better than our original bubble sort method.

Although taking a different approach to a particular problem can often reduce the execution time, that is not always the case. There are usually 'fiddles' which you can use.

Take a look at the sliding block puzzle in figure 10. The idea is to slide the blocks, one at a time, swapping them with the single space, in order to move them into the target position. Figure ten shows the puzzle as it first appeared. See if you can solve it.

To show how this type of puzzle is tackled, we'll choose the slightly easier 8-Puzzle. This is shown in figure 11, where the target position should be all eight numbers in order around a space in the centre. The way to tackle this is to start building a game tree, similar to a family tree, with the branches growing downwards.

At each position, branches are grown to all the next possible positions, and so on. Eventually you'll reach the target position, and by working your way back through the branches, you can trace the necessary moves.

You could continue growing the tree indefinitely, and find lots of target positions, but the highest one will be the best solution.

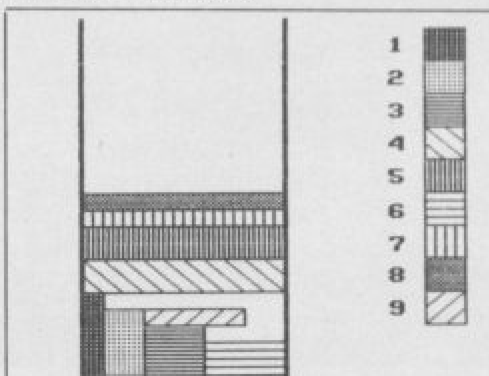


Figure 7. Rectangles in order of decreasing height. This gives optimum total height.

Even with only two to four branches from each position, the tree could be pretty large, and take a long time to search. Imagine how much worse it

continued on page 64

Illustration: Stephen Wright

continued from page 63

would be if we applied the same method to such games as draughts and chess. Consequently, we use what are known as heuristics. Those are scores which we assign to each position to decide now near to the target we are.

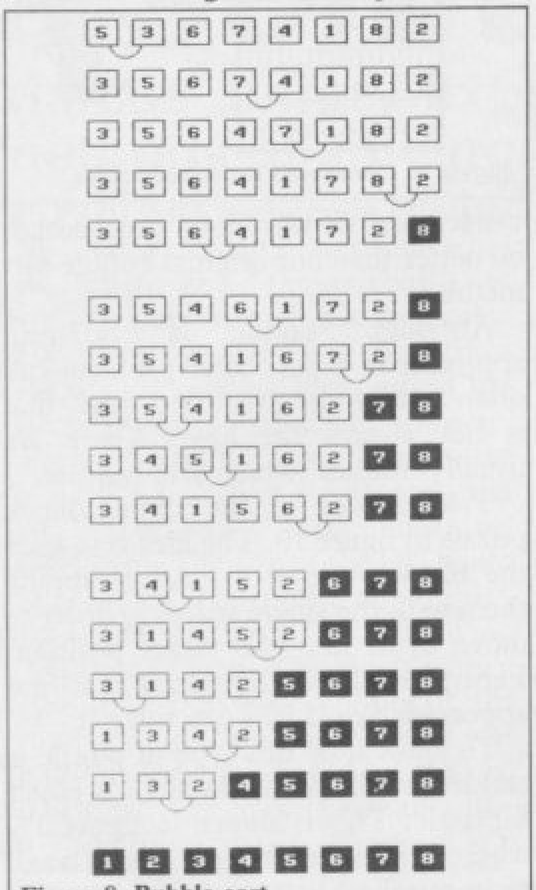


Figure 8. Bubble sort.

With the sliding block puzzles, we might use the Manhattan Distances. We take the number of vertical and horizontal places of each square from its final location, and add them together. That evaluation is then assigned to the position, and the positions with the best evaluations are always considered first. The Manhattan Distance evaluation is not necessarily the best, but it does at least give some indication of which positions are likely to be best.

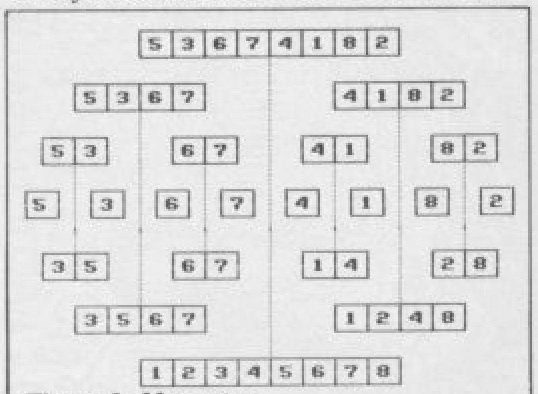


Figure 9. Mergesort

The examples in this article give some indication of the variety of methods with which many common computer problems can be solved. If a program seems to be taking too long, then take another look at it. Changing the data structure or approach may greatly improve matters.

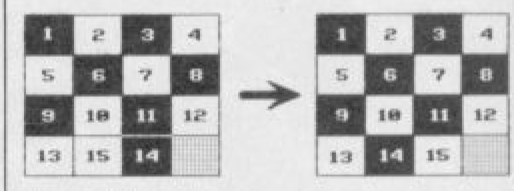


Figure 10.

Unfortunately, not every problem can be solved quite so easily. Though game trees, such as the one above, are used in computer chess playing, it's going to be quite a while before we have a perfect chess machine. Over thirty years ago, C Shannon pointed out that there are something like 10^{120} possible chess games of 40 moves – the average length of a game. This figure is larger than the number of atoms in the universe.

By the way. The sliding block problem in figure 10 is impossible.

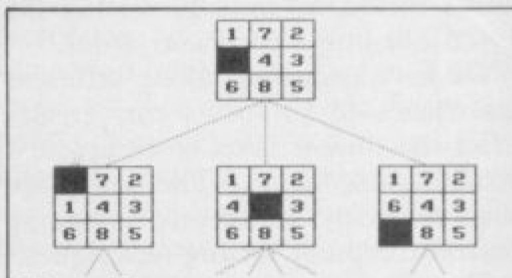
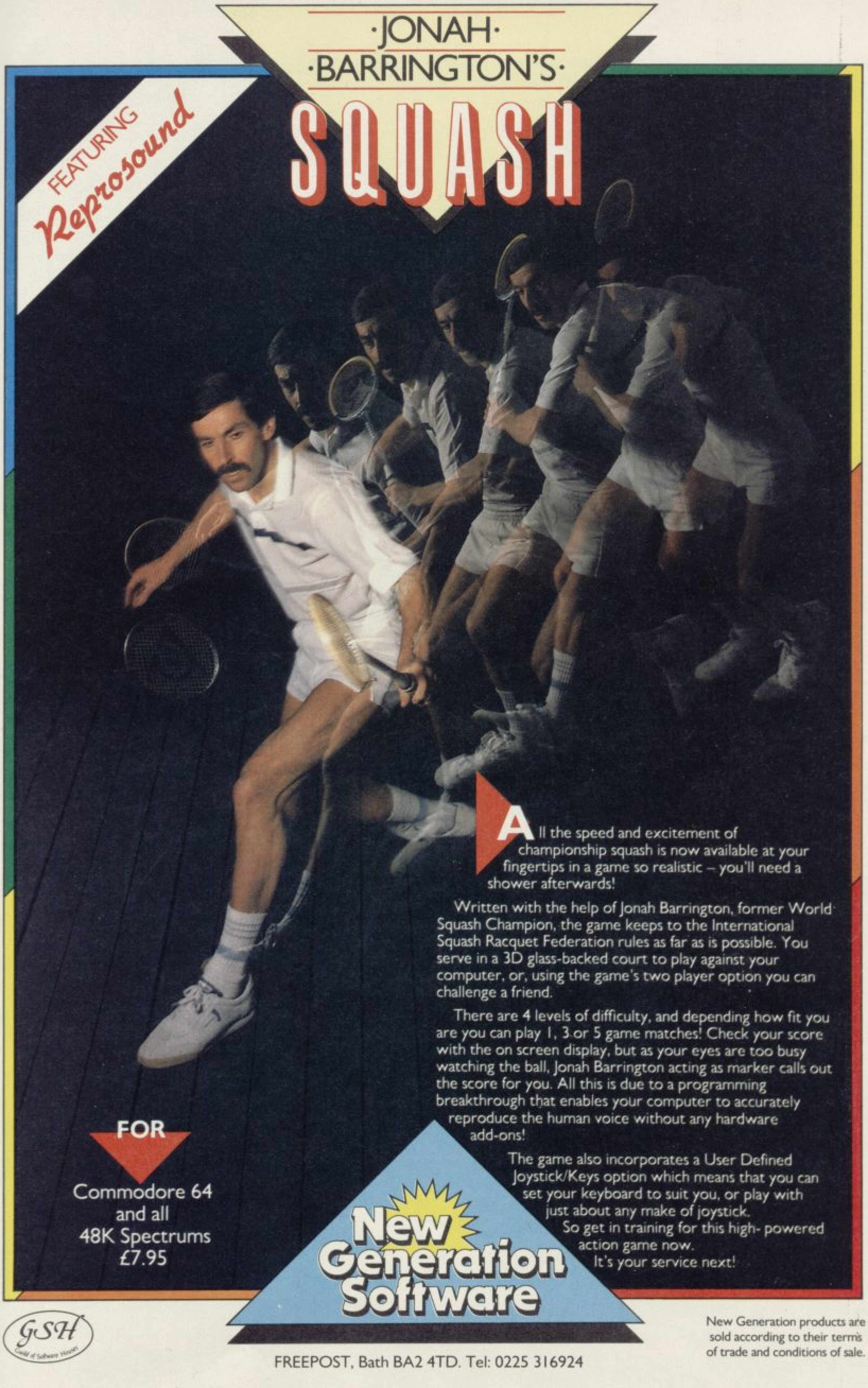
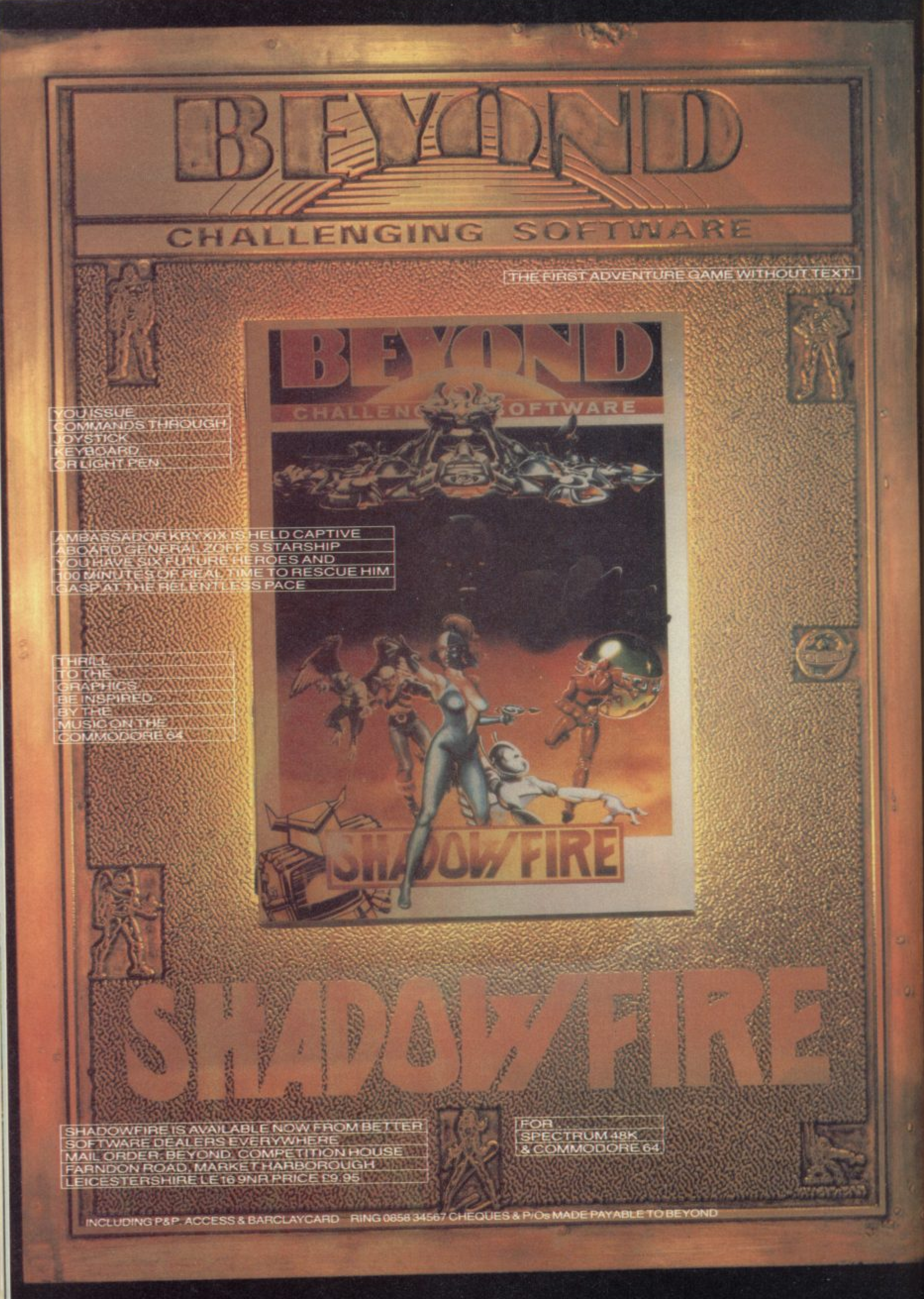
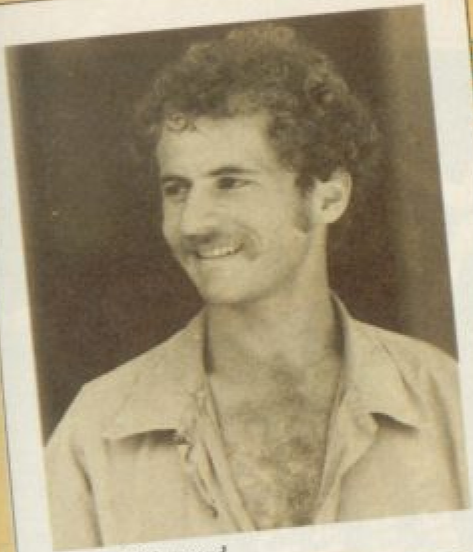


Figure 11.


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Michael Diamond

Computing for the kibbutz

Meet the Israelis with a Spectrum way of life. Michael Diamond is your guide

KIBBUTZ Kfar Hanassi, next to the Jordan River, overlooking the Golan Heights, is a community of 250 families which produces a variety of products for the agricultural market as well as for industry.

The agricultural involvement of the kibbutz covers cotton, apples, citrus, avocados, chicken and sheep, while among the things produced for industry are stainless steel ball valves, of such high quality that they are used in nuclear installations worldwide, and cast aluminium irrigation equipment for other farming communities in Israel.

Given the diversity of operations, together with the fact that the domestic life of the community must also be catered for, it is scarcely surprising that computers play a large role in the life of the kibbutznik. Many of those computers are Spectrums.

"We have an IBM for record keeping, inventory control, and so on," says Michael Doari, farm manager. "However, this machine is in use 24 hours a day in the factory. The Spectrum is ideal for the on-site applications."

At the moment there are about 12 Spectrums on the kibbutz. Those are owned mainly by households, but since the individual's private life and work are so closely related on a kibbutz most owners of those machines are using them in their jobs.

Phyllis Collett is a midwife who, when she is not delivering babies, works in the laundry, washing and drying the clothes for the 500 people on the kibbutz. Phyllis used her Spectrum initially as a word processor for preparing questionaires, information sheets – in English and Hebrew – and all the paperwork that is required in her occupation as midwife.

She soon obtained a program to record her weekly, monthly and yearly wash loads. "We must know how much washing powder we are using, how many hours of labour are going into the job, how many maintenance hours and the quantities of different sorts of wash," she explains. "Altogether we have over 50 categories which must be recorded.

"I considered using a spreadsheet program originally but I decided that a specialised program would be more appropriate. I found a member on the kibbutz who could write in Basic and I soon had the laundry record-keeping fully computerised.

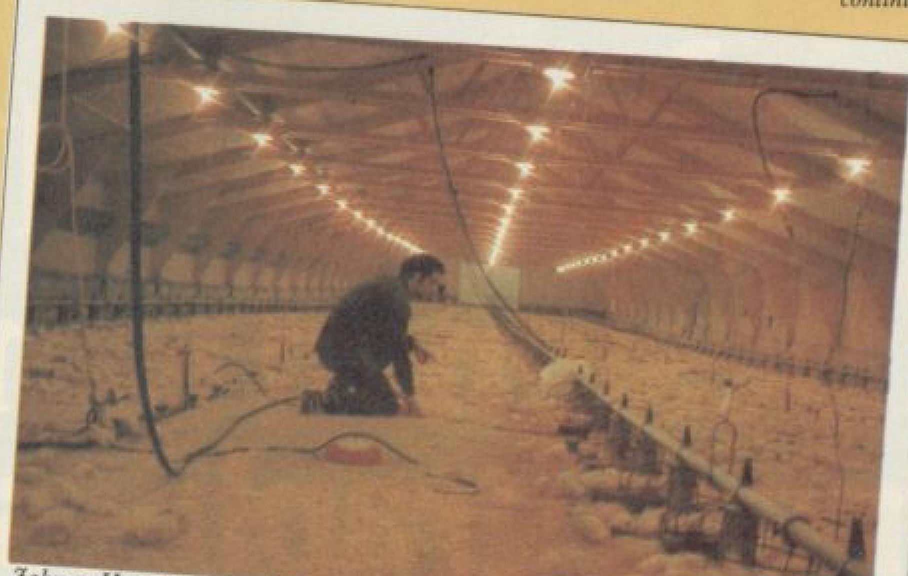
"The next project is to translate the program into Hebrew so that it can be distributed to other kibbutzim. We already have a Hebrew character set. All we need do is a simple exchange of characters, taking into account that Hebrew runs from right to left."

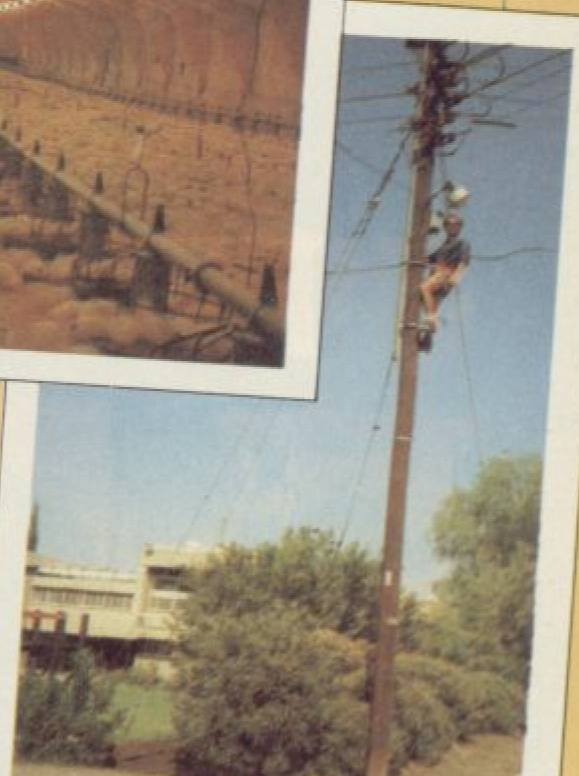
Phyllis' husband Dov also uses the computer. He is a photographer. "The kibbutz was established 37 years ago, in the same year of the state of Israel. Since that time a pictorial record has been kept of all developments. We have come a long way since the days when we used to live in tents and shift stones with our bare hands," says Dov. "Many, many photographs have been taken and somebody has to keep track of where they can be found. I use **Vu-File** for this but, due to the number of photographs, I need to keep more than one file. I have the program and files on microdrive so it doesn't take too long to find what I'm looking for."

Johnny Harmatz is in charge of chicken production. Each year he takes delivery of at least four flocks. They come in as one day old chicks and are kept until they are about seven or eight weeks old. Their living conditions must be carefully controlled – even a one degree change in temperature can have a dramatic effect on the birds.

"When you have 65,000 chickens in one building it is very important to monitor every aspect of their existance," says Johnny. "It is important to

continued on page 69


Johnny Harmatz counts his chickens


Michael gets a better view of the kibbutz

continued from page 67

analyse what difference it makes to the flock if we make a minor change.

"Perhaps we have a flock which is not gaining weight as it should. It may be that we have to alter the feed so that it contains more proteins or amino acids. It may be that the temperature in the building is too low, or the birds are too densely packed together. What happens if the price of chicken feed increases? We have to calculate the costs involved and the difference it will make to the profit. A spreadsheet program is perfect for analysing the effect of change.

"At the moment we are using **Vu-Calc** but it is limited with only 60*60 cells. Ideally we need a larger computer, but the Spectrum does the job efficiently." The next step is to get a statistical analysis package which will give a graphics illustration of the relationships between the figures.

"Software here is a bit thin on the ground," adds Johnny. "I scour the English computer magazines for information, but with a new flock about to arrive I have very little time to experiment." With this Johnny runs off to deal with yet another emergency.

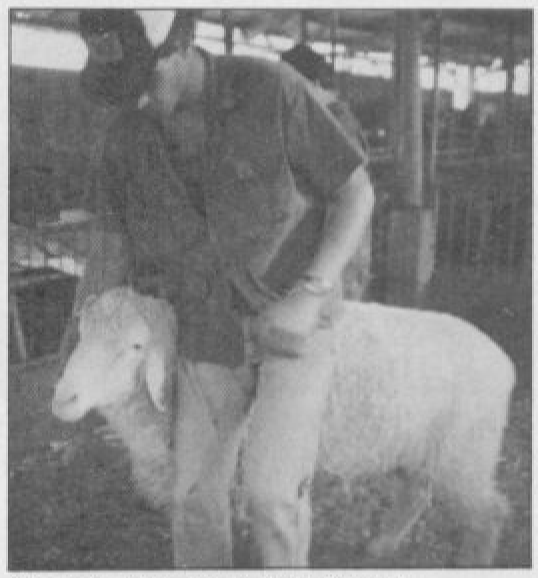
The Spectrum has made its mark also in education on the kibbutz. The local high school has a network of 15 Spectrums. "The advantages of the network are enormous," says Yoram Fisher, the teacher in charge of the computer room. "We have to buy only one or two printers and a couple of microdrives and anybody on the network can operate the peripherals.

"Even the teachers in the English classes have noted an improvement in the performance of the children. It doesn't seem to matter whether they program or just play games, they must still read the instructions. We have one boy of 15 who has just completed a machine code version of Othello. It is more than a match for the Sinclair version."

A kibbutz is an ideal place to set up a network as all the houses are close together and there is no difficulty in leading wires from one to another. Kfar Hanassi intends to set up a fully operative network shortly, once there are more Spectrums to link up.

Meanwhile a large market has developed in Israel for programs in Hebrew. Each child on Kfar Hanassi who owns a Spectrum has a translation of the manual along with introductory programs. The programs were written by one of the teachers at the high school and the book is published by the importers of the Spectrum.

At the moment only **Vu-Calc** is available in Hebrew along with a reasonable word processor but the Israel market has still to see a good database package in Hebrew or even an adventure game. The market is crying out for Hebrew software.



Sheep-shearing time at Kfar Hanassi

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Illustration: Stephen Wright

Survey II

ANALYSING survey results is not easy and a computer of some sort is usually pressed into service. Now, with **Survey II** from Lobos Software, available from Microworkshops, your humble Spectrum or 16K ZX81 can be used to do the job.

Survey II is designed to analyse those surveys with up to six possible answers to each question, and where only one of such answers is valid. Up to 2500 10-question questionaires can be dealt with on the 48K Spectrum.

No allowance is made for storing data on microdrives. The program is designed to drive a ZX printer or a full-sized printer with ZX Lprint III interface. The manual states that by altering the program other interfaces can also be used, although I could not get the Tasman interface to work.

The most horrendous part of any analyses program is entering the data, and **Survey II** is no exception. When starting on a new survey the number of questionaires, the number of questions, and the number of possible responses to each question are entered. If you try to define more data than the program can cope with you are politely told so, and offered the chance to buy, for a further £10.00 a version which will handle up to 3000 questionaires of 10 questions but with fewer error traps.

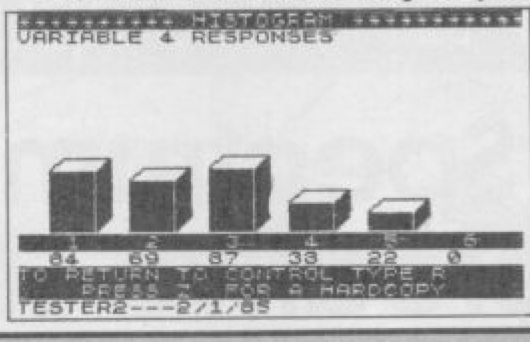
The data can then be entered as a string of numbers. A flashing figure at the top of the screen indicates which case number the data is for. If too many, or too few, figures are entered the data is rejected and must be re-entered.

The program checks for data outside the specified range. Unanswered questions are coded with a '9'. The tedium of data entry can be banished to some extent by providing a SAVE option which allows partially entered data to be saved together with the program.

Once the data has been entered it is displayed on the screen and you are given an opportunity to change incorrect data. That can be done at any stage within the program.

Survey II provides two analysis options. The first displays the frequency of different responses to questions; the percentage and cumulative percent are shown also. The results can be displayed as a 3D histogram.

The second shows the frequency of



combinations of responses to two questions – crosstabulation, a statistic showing the likelihood of the results occurring by chance can also be obtained.

A full printout of all the data, frequency and crosstabulation charts can be obtained if you have the time. With the sample provided, with 300 cases of six questions, it took over half an hour to printout.

Considering the slowness with which frequencies, for even a medium-sized sample, are calculated the screen display is uninformative. That, and the fact that program and data cannot be saved to microdrive, are my only criticisms. Otherwise **Survey II** is a solid program which is well protected against accidental crashes.

Mike Wright

Publisher Lobos Software, 10 Randall Place, Bradford, W.Yorkshire, BD9 4AE. Available from Microworkshops, 1 Park Lane, Baildon, Shipley, West Yorkshire, BD17 7LQ.
Memory any Spectrum, 16K ZX-81
Price £10.00
★★★

Bizzicom

WHEN a program like **Bizzicom** from Merlin Software, which relies solely on tape storage of data and a ZX type printer, is released there is an immediate feeling of disappointment.

Bizzicom consists of two programs; the first Bizzicom-1, is a stock control system, while the second, Bizzicom-2, provides business analyses from the data prepared by the first. Both sides of the tape have the same label making it difficult to differentiate between the two programs.

The manual is strong on what the programs are capable of doing but weak on giving any explanation or guidance, preferring instead to rely on what used to be described as user friendliness and the user's innate intelligence.

Bizzicom-1 caters for up to 390 different stock items. Each is defined by a six character code, the first two of which are used to link similar items into groups. A 14 character description is also available to expand on the code.

For new entries the average cost price, the selling price and details of the cost price and quantity of any order are entered along with the stock level. Those details, together with the dates of the last receipt, issue, order and menu of further options, are also displayed when changes need to be made to the date.

The screen displays and the method of data entry have been well thought out and it is a pity that they are spoilt by the rest of the program. It has been fairly well protected from crashing when entering data, although still susceptible to CAPS SHIFT and SPACE. However, I found that it crashed regularly with the 'Interger out of range' message, despite there being no obvious flaw in any of the data entered.

Similar problems occurred with Bizzicom-2. At first it crashed when I

continued on page 72

continued from page 71

tried to load the amended transaction files saved from Bizzicom-1. So I tried the sample files provided, or I would have done if they had been there.

Finally, I loaded Bizzicom-1 and saved the transaction files without any amendments. The result was the same, the program crashed with the report '3 Subscript wrong'.

Bizzicom-2 is supposed to produce financial reports, including VAT payable and recoverable, from the sales and purchases of the stock control program. Since most businesses can reclaim VAT from items other than those bought for resale the VAT recoverable report is likely to be understated.

Although the program is of no practical use in its present form, the screen layout and prompting in the first part could, with a lot of work, form the basis for a promising program.

Mike Wright

Publisher Merlin Software, Business & Technology Centre, Bessemer Drive, Stevenage, Hertfordshire SG1 2DX
Memory 48K **Price** £14.95
★

Statistics II

STAR GAZERS might be familiar with Bridge Software, publishers of the much acclaimed **Night Sky** program. Also included in the range is **Statistics I**, which consists of two programs. The first produces simple statistics for data arranged in groups. The second performs analyses of data in pairs.

There are four main options for the grouped data program. Those allow data entry and deletion, summary statistics, uncorrelated test and analyses of variance.

Data entry is relatively easy, with each group of data given a name before the data is entered. Up to 10 groups can be used at a time. The last piece of data entered is shown on the screen, and can be corrected at any time until the next piece of data has been entered, or data entry abandoned.

In what is a major omission there is no opportunity to list, examine or alter data once past that point, although it is possible to delete a whole group of data if something is wrong.

The three statistical options all produce analyses quickly but lack the sophistication of other programs. Statistical tables are still required to look up the results. The screen layout gives the results in a straightforward, no frills, manner.

The program would not include all 10 groups in the analyses of variance, despite it shown as a possibility.

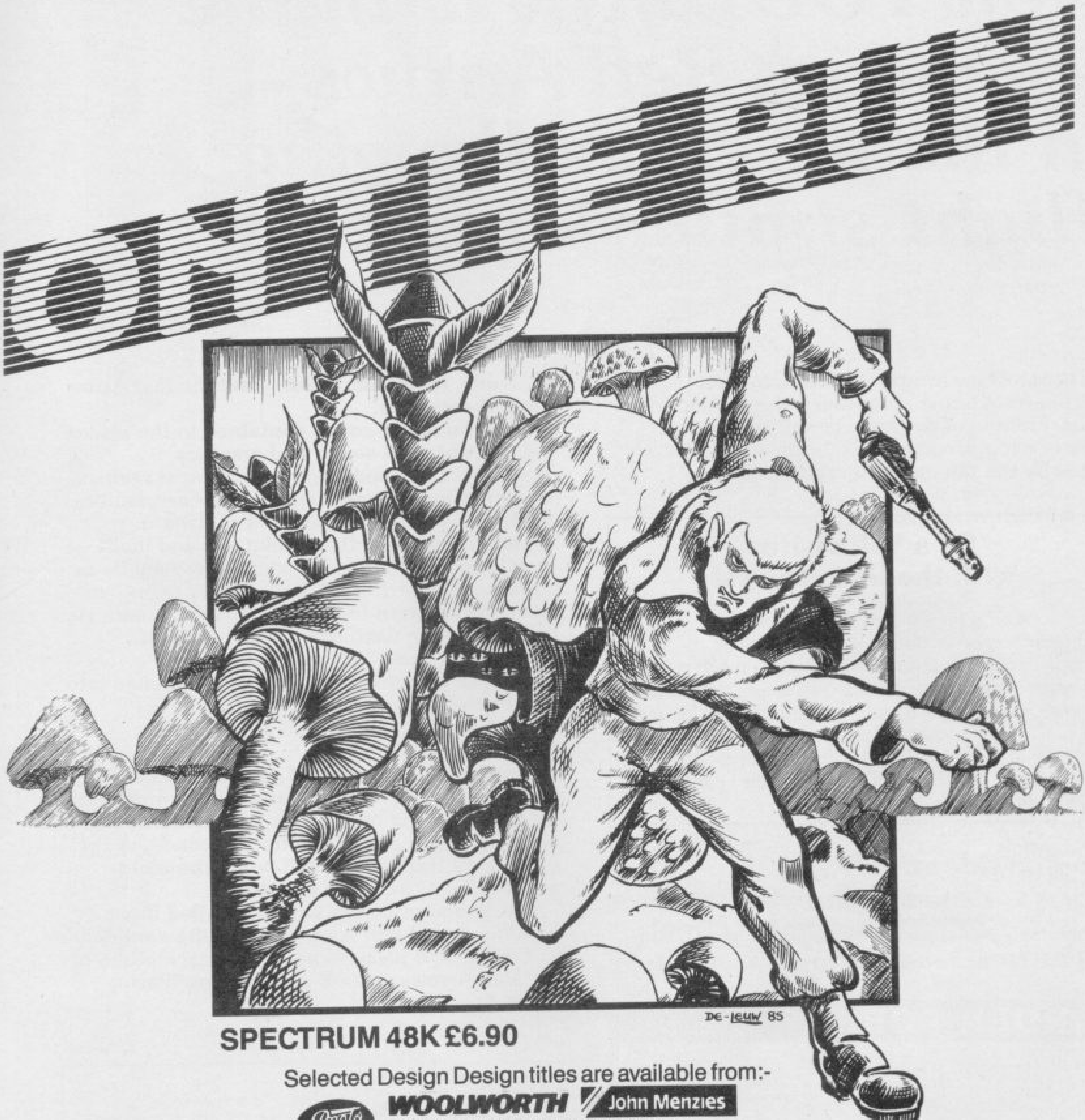
In the paired data only one set can be entered at a time. Entering a new data name automatically overwrites the old set. The same criticism applies to seeing and correcting data in the grouped data program also applies.

The manual claims that the program is crash proof. On occasion, however, extra large numbers or a mixture of numbers and text both stopped the program.

The claims for user friendly programs are over-exaggerated, but as the programs do not do a great deal they cannot help but be user friendly.

Mike Wright

Publisher Bridge software, 36 Fernwood, Marple Bridge, Stockport, Cheshire SK6 5BE.
Memory 16K **Price** £6.90
★



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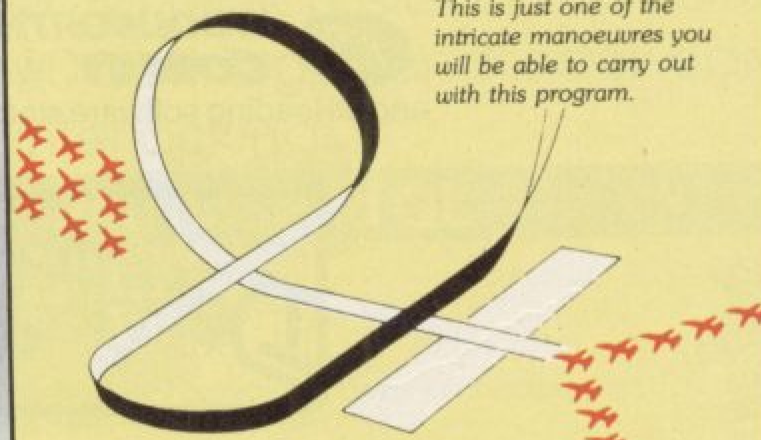
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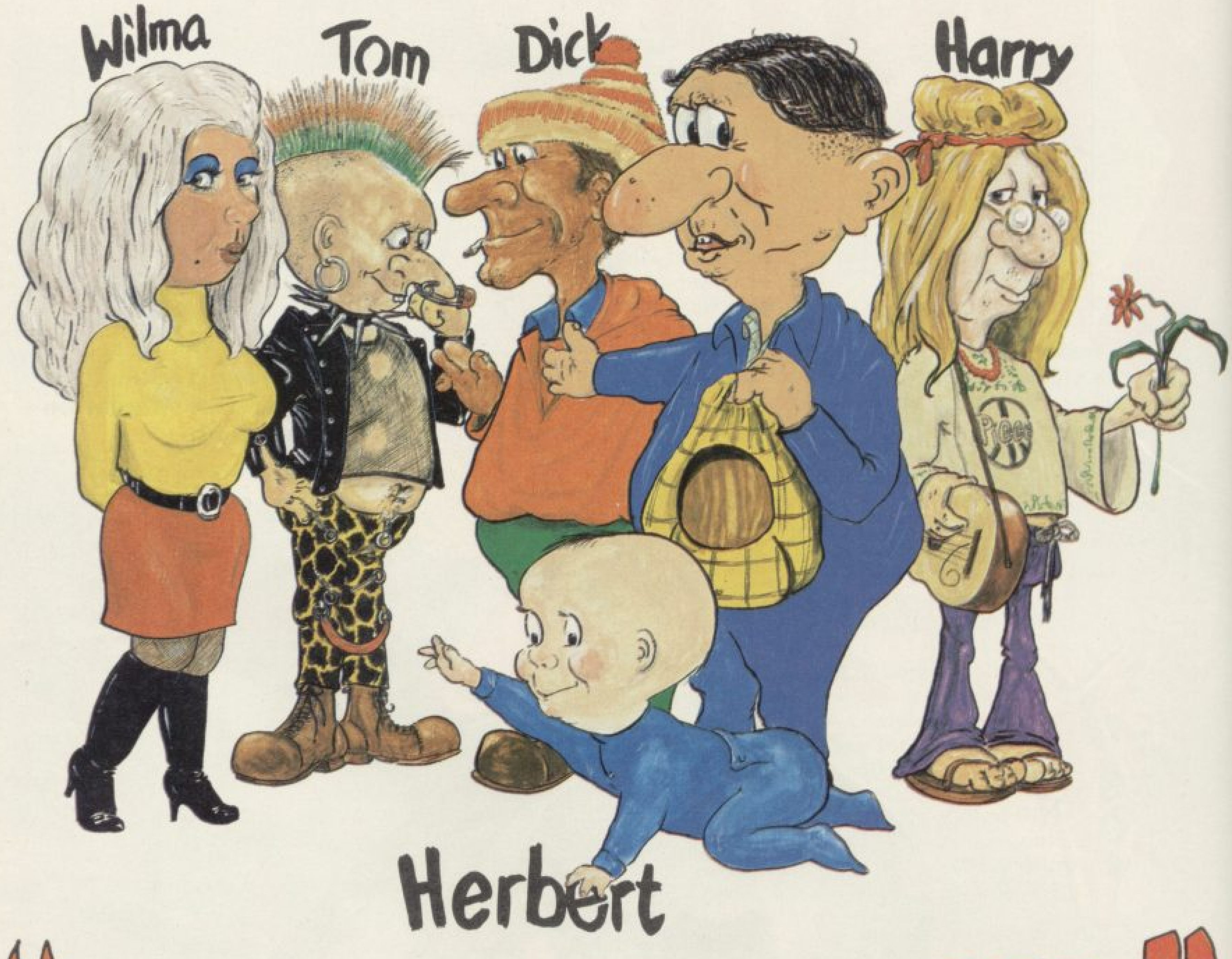
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PROGRAM PRINTOUT

GRAPHICS INSTRUCTIONS

IN GENERAL, graphics abbreviations are enclosed in brackets, which should not be entered. A string of the same graphics character is represented in the form (3*A) which would be entered as AAA, where A is the graphics character. A space, where it is important to have the correct number of spaces, is indicated by (sp). Spaces in text will not normally be indicated. Where several graphics characters are used, they are separated by commas, which should not be entered. With Spectrum and QL listings the letter I has a flat top and the numeral 1 has a sloping top.

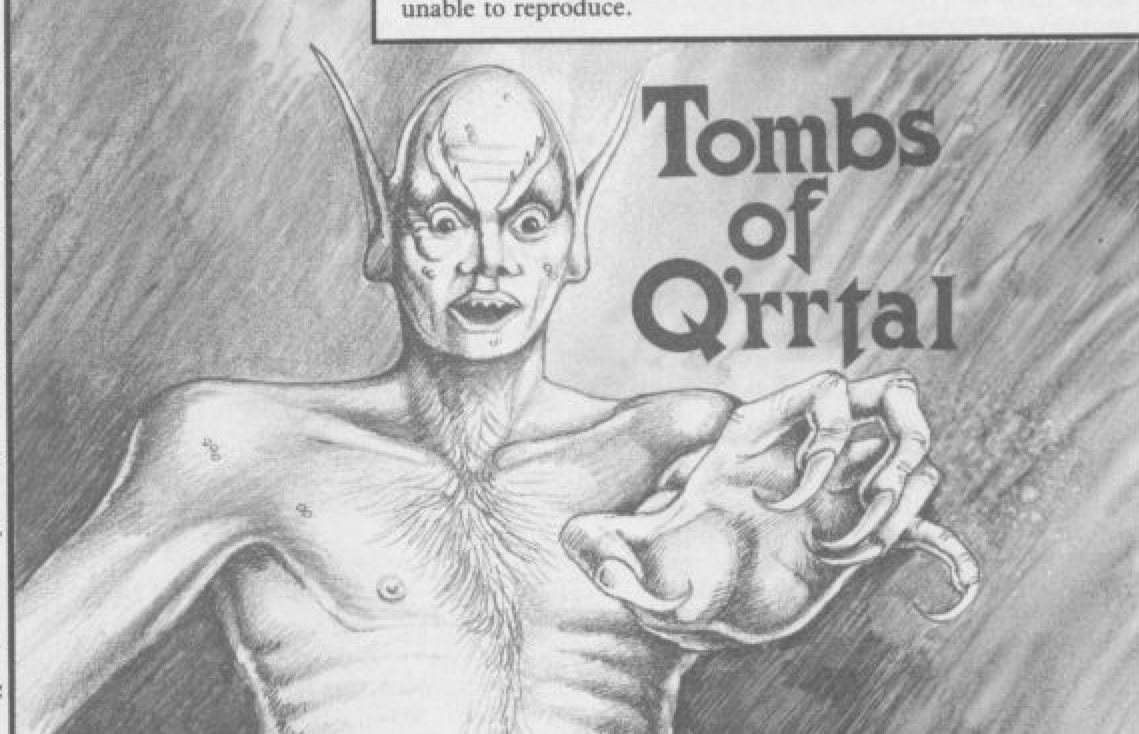
The above applies to all Sinclair machines. The following instructions are for specific machines.

ZX-81: ZX-81 listings are generally reproduced as they appear when you enter them, spaces and all. Where extensive graphics are used, REM statements will be inserted to provide a guide to the position of each character.

Spectrum: User-defined graphics are represented by underlined letters, without brackets. Type the appropriate letter while in graphics mode. The underline does not appear on the screen. Inverse characters have the letter i before them, e.g. iZ, iA, iP. Block graphic characters are indicated by g followed by the number of the appropriate key: g4 would mean the block graphics on key 4, ig4 the inverse of that graphic.

Control codes are indicated by cc before the character, and are obtained by pressing CAPS SHIFT while in extended mode. They do not appear on the screen but may change the colour of the cursor and will affect what is printed after them: cc3,i* would thus have the effect of printing an inverse asterisk in red.

QL: User-defined graphics on the QL are indicated by a description of the keys pressed to obtain them, underlined and in brackets. Thus (CTRL + 9) means press CTRL and 9 together. The same applies for unusual characters within the QL character set, which our printer is unable to reproduce.



Tombs of Q'rrtal

DOOM AWAITS the unwary in the **Tombs of Q'rrtal**. A combination of arcade skills and adventure wisdom will help you survive the nameless horrors within, and possibly win you enough treasure to make the risk worthwhile.

Written by Steve Williams of Malvern, Worcester, **Tombs of Q'rrtal** takes you into an underground labyrinth to do battle for your life. The modular system of programming will enable experienced users to add their own monsters and special problems if they wish.

The program uses our special abbreviations for graphics characters, so please read the instructions above before entering the listing.

```
   1 RANDOMIZE
   5 BORDER 1: INK 0: PAPER 7: C
LS
  10 GO SUB 6000
  20 REM 26.2.85 Steve Williams
  30 GO SUB 8000
  40 GO TO 150
 100 REM mainline
 110 LET die=INT (RND*10)
 120 IF die=0 THEN  GO TO 7200
 130 IF die=1 THEN  GO TO 7400
 140 IF die<6 THEN  GO TO 7600
 150 GO SUB 6850: GO SUB 6800: P
RINT AT 13,1;"You see a door ahe
ad..."''TAB 1;"Options:-"''TAB 1
;"(1) Go in"'TAB 1;"(2) Walk on
by": GO SUB 8900: BEEP .1,10
 160 IF INKEY$="" THEN  GO TO 16
0
 170 IF INKEY$="1" THEN  GO TO 2
10
 180 IF INKEY$="2" THEN  GO TO 7
800
 190 GO SUB 6900: GO TO 160
 220 GO SUB 6800: LET die=INT (R
ND*3)
 230 IF die=0 THEN  GO TO 500
 240 PRINT AT 13,1;"The door is
locked";''TAB 1;"Options:-";''TA
B 1;"(1) leave"'TAB 1;"(2) smash
 it down": BEEP .1,10
 250 IF INKEY$="" THEN  GO TO 25
0
 260 IF INKEY$="1" THEN  GO TO 7
800
 270 IF INKEY$="2" THEN  GO TO 3
00
 280 GO SUB 6900: GO TO 250
 300 GO SUB 6800: LET die=INT (R
ND*10)
 310 IF die<hits THEN  GO TO 400
 320 BEEP .3,5: BEEP .5,0: PRINT
 AT 13,1;"It won't budge so you
decide to leave"''TAB 5;k$
 330 IF INKEY$="" THEN  GO TO 33
0
 340 GO TO 7800
 400 GO SUB 6850: GO SUB 8400: P
RINT AT 13,1;"You smash it down
and go inside"''TAB 5;k$: BEEP .
1,10
 410 IF INKEY$="" THEN  GO TO 41
0
 500 GO SUB 6800: LET die=INT (R
ND*3)
 510 IF die>0 THEN  GO TO 600
 520 GO SUB 8500: PRINT AT 13,1;
"There is no-one here."''TAB 1;"
Options:-"''TAB 1;"(1) Search th
e room"'TAB 1;"(2) leave": BEEP
.1,0
 530 IF INKEY$="" THEN  GO TO 53
0
 540 IF INKEY$="1" THEN  GO TO 5
80
 550 IF INKEY$="2" THEN  GO TO 7
800
 570 GO SUB 6900: GO TO 530
 580 GO SUB 6800: LET tres=INT (
RND*4)
 590 LET time=time+1: GO SUB 660
0
 595 GO TO 100
 600 GO SUB 6850: LET die=INT (R
ND*8): GO SUB 9000+die*100
 610 READ mhtk,mstren,mspeed,mpt
s,m$
 620 PRINT  FLASH 1;AT 1,1;m$
 630 BEEP .1,10: PRINT AT 13,1;"
Options:-"''TAB 1;"(1) Fight it"
'TAB 1;"(2) Run away"
 640 LET f=0
 650 IF INKEY$="" THEN  GO TO 67
0
 660 GO TO 800
 670 LET f=f+1: BEEP .05,f*2
 680 IF f>20 THEN  GO TO 700
 690 GO TO 650
 700 GO SUB 6800
 710 PRINT AT 13,1;"It was quick
er...you must fight": FOR f=1 TO
 5: BEEP .1,30: NEXT f
 720 GO TO 1000
 800 IF INKEY$="1" THEN  GO TO 1
000
 810 IF INKEY$="2" THEN  GO TO 8
40
 820 GO SUB 6900
 830 GO TO 640
 840 IF speed>mspeed THEN  GO TO
 6200
 850 GO SUB 6800
 860 PRINT AT 13,1;"You are unab
le to get away": FOR f=1 TO 20:
NEXT f
 870 GO TO 1000
1000 GO SUB 6800
1010 PRINT AT 13,1;"You are now
in combat......."
1020 FOR f=1 TO 5: BEEP .1,20: N
EXT f: GO SUB 2000: GO SUB 6800:
 LET factor=mstren+INT (RND*6+1)
```

continued on page 78

continued from page 77

```
-stren-INT (RND*5)-(score>4)-(sc
ore>7)
1030 IF factor>0 THEN  GO TO 110
0
1040 IF factor<0 THEN  GO TO 120
0
1050 PRINT AT 13,1;"The battle c
ontinues..."
1060 FOR f=1 TO 200: NEXT f: GO
SUB 6800
1070 GO TO 1400
1100 PRINT AT 13,1;"You have bee
n wounded"
1110 LET hits=hits-factor: FOR f
=1 TO 200: NEXT f
1120 GO SUB 6400
1130 GO SUB 6800
1140 GO TO 1400
1200 LET mhtk=mhtk+factor
1210 IF mhtk<=0 THEN  GO TO 1250
1220 PRINT AT 13,1;"You wounded
it"
1230 FOR f=1 TO 200: NEXT f
1240 GO SUB 6800: GO TO 1400
1250 GO SUB 8500: LET pts=pts+mp
ts
1260 PRINT AT 13,1;"You killed i
t...";AT 9,4;pts
1270 FOR f=1 TO 200: NEXT f: GO
SUB 6800
1280 LET time=time+2: LET tres=I
NT (RND*8): GO SUB 6600
1290 GO TO 7800
1400 GO TO 630
2000 LET score=0: LET cx=15: LET
 cy=19
2020 LET ex=INT (RND*5+13): LET
ey=INT (RND*4+18)
2030 FOR g=1 TO 10: PRINT  PAPER
 INT (RND*7);AT ey,ex;"(sp)"
2035 FOR n=1 TO 15: PRINT AT cy,
cx;"(sp)"
2040 LET cursor=CODE INKEY$
2045 LET cy=cy+(cursor=54 AND cy
<21)-(cursor=55 AND cy>17)
2050 LET cx=cx+(cursor=56 AND cx
<31)-(cursor=53 AND cx>0)
2052 REM to use cursor keys on
spectrum+ put 8-11 insted of 53-
56 in the above two lines
2060 IF (ex=cx AND ey=cy) THEN
LET score=score+1: BEEP .1,10: L
ET n=20
2070 PRINT AT cy,cx;"+"
2075 NEXT n: PRINT AT ey,ex;"(sp
)"
2080 LET ex=ex+(INT (RND*3) AND
ex<30)-(INT (RND*3) AND ex>1)
2090 LET ey=ey+(INT (RND*2) AND
ey<21)-(INT (RND*2) AND ey>17)
2100 NEXT g
2110 RETURN
2130 PRINT AT 18,20;"(ig8)": NEX
T q
2140 RETURN
6000 REM Instructions
6010 PRINT 'TAB 10;"The dungeon"
'''"OBJECT:Gain as many points(p
ts)         as possible in the ti
me          limit.This is done by
            killing monsters and
            getting their treasur
e."
6020 PRINT '';" Your strength is
 shown by your  hits to kill(HTK
) and you die   if this drops to
 zero."
6030 PRINT '';"  (Press any key
to continue)"
6040 PAUSE 0
6050 CLS : FOR f=1 TO 50: NEXT f
6060 PRINT : PRINT TAB 13;"Comba
t"''
6070 PRINT "  When fighting a mo
nster, a        moving square will
 appear.        Try to hit it with
 the +          using keys 5-8 as
it will         help to decide who
 is hit.        You must do this e
very            round in combat"
6080 PRINT : PRINT "  (Press any
 key to continue)"
6090 PAUSE 0
6100 RETURN
6200 REM Escape
6210 PRINT AT 1,1;"(8*sp)"
6220 GO SUB 6800: PRINT AT 13,1;
"You escape......"
6230 FOR f=1 TO 10: BEEP .1,f: N
EXT f: GO TO 7800
6400 REM Check fo hits=0
6410 IF hits>0 THEN  GO TO 6500
6420 PRINT AT 6,4;"0": GO SUB 68
00
6430 FOR f=1 TO 50: NEXT f: PRIN
T AT 13,1;"Too bad you have died
 from your wounds."''" s=stop ,
any other=newgame"
6440 BEEP .3,10: BEEP .6,-10
6450 IF INKEY$="" THEN  GO TO 64
50
6470 IF INKEY$="s" THEN  STOP
6480 RUN 20
6500 PRINT AT 6,4;"(2*sp)";AT 6,
4;hits
6510 RETURN
6600 REM Treasure
6610 IF tres>0 THEN  GO TO 6700
6620 PRINT AT 13,1;"Nothing of v
alue here."''TAB 4;k$
6630 IF INKEY$="" THEN  GO TO 66
30
6640 GO SUB 6800: RETURN
6700 LET pts=pts+tres
6710 CIRCLE 140,90,2: CIRCLE 147
,85,3: CIRCLE 155,90,2: PLOT 145
,100: DRAW 10,0: DRAW 0,-3: DRAW
 0,-6,-PI: DRAW -10,0: DRAW 0,6,
-PI: DRAW 0,3
6730 PRINT AT 13,1;"You found so
me treasure."''TAB 1;k$
6740 IF INKEY$="" THEN  GO TO 67
40
6750 PRINT AT 9,4;"(2*sp)";AT 9,
4;pts
6760 GO SUB 6800: RETURN
6790 RETURN
6800 REM clear messages
6810 FOR f=1 TO 20: NEXT f: FOR
f=13 TO 21: PRINT AT f,0;c$: NEX
T f: RETURN
6820 PRINT AT 1,1;"(8*sp)"
6850 REM clear screen
6860 LET paper=INT (RND*3+4): FO
R f=1 TO 20: NEXT f: FOR f=1 TO
11: PRINT  PAPER paper;AT f,10;"
(17*sp)": NEXT f
6865 PRINT AT 1,1;"(8*sp)"
6870 RETURN
6900 REM error beep
6910 BEEP .6,0: FOR f=1 TO 20: N
EXT f
6920 RETURN
7200 REM Stairs
7210 GO SUB 6850: GO SUB 6800: G
O SUB 8800
7220 LET die=INT (RND*2)
7230 PRINT AT 13,1;"You arrive a
t a dead end with"
7240 IF die=1 THEN  GO TO 7280
7250 PRINT " stairs going down."
7255 PLOT 133,94: DRAW -10,-5: D
RAW 49,0: DRAW -10,5
7260 LET level=level+1: GO TO 73
10
7280 PRINT " stairs going up."
7285 PLOT 133,152: DRAW -10,5: D
RAW 49,0: DRAW -10,-5
7290 LET level=level-1
7310 PRINT " You must take them.
"
7320 PRINT 'TAB 5;k$: BEEP .1,10
7330 IF INKEY$="" THEN  GO TO 73
30
7340 GO TO 7800
7400 REM TRAP
7410 GO SUB 6850: GO SUB 6800: G
O SUB 8600
7420 LET DIE=INT (RND*2)
7430 IF DIE=0 THEN  GO TO 7520
7440 PRINT AT 13,1;"You just fel
l down a trap and    hurt yoursel
f."
7450 LET hits=hits-1
7460 PRINT 'TAB 5;k$
7470 IF INKEY$="" THEN  GO TO 74
70
7480 GO SUB 6400
7490 GO TO 7570
7520 PRINT AT 13,1;"You just fel
l down a trap but    were not hur
t."
7550 PRINT 'TAB 5;k$
7560 IF INKEY$="" THEN  GO TO 75
60
```



```
7570 LET level=level+1
7580 GO TO 7800
7600 REM Corridor
7610 GO SUB 6850: GO SUB 6800: G
O SUB 8700
7620 PRINT AT 13,1;"You are in a
 corridor."''TAB 5;k$
7630 IF INKEY$="" THEN GOTO 7630
7640 GO TO 7800
7800 REM timecheck
7810 GO SUB 6800
7820 LET time=time+1
7830 IF time<50 THEN  GO TO 100
7840 PRINT AT 13,1;"Your time li
mit is up."''TAB 1;"s to stop, a
nother for new game"
7850 IF INKEY$="" THEN  GO TO 78
50
7860 IF INKEY$="s" OR INKEY$="S"
 THEN  CLS : STOP
7870 RUN 20
8000 REM set up
8010 PAPER 7: BORDER 1: CLS
8020 FOR f=1 TO 11: PRINT  PAPER
 7;AT f,10;"(17*sp)": NEXT f
8030 PLOT 79,79: DRAW 137,0: DRA
W 0,89: DRAW -137,0: DRAW 0,-89
8040 PLOT 15,90: DRAW 45,0: DRAW
 0,55: DRAW -45,0: DRAW 0,-55
8050 PRINT AT 5,3;"HTK";AT 8,3;"
PTS";AT 6,4;"20";AT 9,4;"0"
8100 LET c$="(32*sp)"
8110 LET k$="(any key to continu
e)"
8140 LET stren=3
8150 LET speed=INT (RND*4)
8160 LET level=1
8170 LET hits=20
8180 LET time=0
8190 LET pts=0
8199 RETURN
8400 REM Smash door
8410 PLOT 125,80: DRAW 0,45: DRA
W 50,0,-PI: DRAW 0,-45
8499 RETURN
8500 REM Room
8510 GO SUB 6850
8520 PLOT 79,79: DRAW 40,15: DRA
W 57,0: DRAW 40,-15: PLOT 79,168
: DRAW 40,-15: DRAW 57,0: DRAW 4
0,15: PLOT 119,94: DRAW 0,59: PL
OT 177,94: DRAW 0,59
8590 RETURN
8600 REM Trap
8610 PLOT 80,79: DRAW 40,20: DRA
W 0,48: DRAW -40,20: PLOT 216,79
: DRAW -40,20: DRAW 0,48: DRAW 4
0,20: PLOT 108,167: DRAW 20,-6:
DRAW 40,0: DRAW 20,6
8620 BEEP .1,10
8690 RETURN
8700 REM Corridor
8710 PLOT 80,79: DRAW 40,20: DRA
W 0,48: DRAW -40,20: PLOT 216,79
: DRAW -40,20: DRAW 0,48: DRAW 4
0,20: BEEP .1,10
8790 RETURN
8800 REM Stairs
8810 PLOT 138,90: DRAW 0,65: PLO
T 158,90: DRAW 0,65: PLOT 138,15
0: DRAW 20,0: PLOT 138,140: DRAW
 20,0: PLOT 138,130: DRAW 20,0:
PLOT 138,120: DRAW 20,0: PLOT 13
8,110: DRAW 20,0: PLOT 138,100:
DRAW 20,0
8820 PLOT 80,79: DRAW 30,15: DRA
W 0,58: DRAW -30,15: PLOT 216,79
: DRAW -30,15: DRAW 0,58: DRAW 3
0,15: PLOT 108,94: DRAW 78,0: PL
OT 110,152: DRAW 78,0
8899 RETURN
8900 REM door
8910 PLOT 125,80: DRAW 0,45: DRA
W 50,0,-PI: DRAW 0,-45: CIRCLE 1
65,115,3
8990 RETURN
9000 REM Ghost
9010 PLOT 140,140: DRAW 20,0,-1.
5*PI: DRAW 20,20: DRAW 10,-30: D
RAW -25,5: DRAW 10,-45
9020 DRAW -50,0,-PI/4: DRAW 10,4
5: DRAW -25,-5: DRAW 10,30: DRAW
 20,-20
9030 PLOT 145,155: DRAW 0,-10,PI
/2: DRAW 0,10,PI/3: PLOT 155,155
 : DRAW 0,-10,PI/3: DRAW 0,10,PI/
2
9040 PLOT 157,140: DRAW -15,-5,P
I/3: DRAW 15,5,PI/3
9050 PLOT 80,110: DRAW 50,0: PLO
T 172,110: DRAW 44,0
9070 RESTORE 9000
9080 DATA 4,1,3,10,"Ghost"
9090 RETURN
9100 REM Troll
9110 CIRCLE 150,150,10: CIRCLE 1
46,153,2: CIRCLE 154,153,2
9120 PLOT 147,143: DRAW 6,0,-PI:
 PLOT 143,144: DRAW -15,-30,PI/2
 : DRAW 10,20,-PI/2
9130 DRAW 0,-40,PI/5: DRAW -10,-
5: DRAW 10,0: DRAW 10,20,PI/2: D
RAW 2,0: DRAW 10,-20,PI/2: DRAW
10,0: DRAW -10,5: DRAW 0,40,PI/5
 : DRAW 10,-20,-PI/2: DRAW -12,30
,PI/2
9140 PLOT 141,128: DRAW 5,0,PI/2
 : PLOT 151,128: DRAW 5,0,PI/2
9150 PLOT 129,90: DRAW 0,70: DRA
W -3,-8: DRAW 6,0: DRAW -3,8
9160 PLOT 80,110: DRAW 55,0: PLO
T 163,110: DRAW 53,0
9170 RESTORE 9100
9180 DATA 9,2,1,25,"Troll"
9190 RETURN
9200 REM spider
9210 CIRCLE 150,115,20: CIRCLE 1
50,110,10: CIRCLE 147,110,2: CIR
CLE 154,110,2: PLOT 145,103: DRA
W 10,0,-PI/2
9220 PLOT 164,130: DRAW 15,15: D
RAW 15,-45: PLOT 135,130: DRAW -
15,15: DRAW -15,-45
9230 PLOT 164,110: DRAW 12,3: DR
AW 5,-20: PLOT 137,110: DRAW -12
,3: DRAW -5,-20
9240 PLOT 80,105: DRAW 53,0: PLO
T 168,105: DRAW 48,0
9250 RESTORE 9200
9260 DATA 5,1,1,10,"Spider"
9290 RETURN
9295 REM
9300 REM Skeleton
9310 CIRCLE 150,145,6.5: CIRCLE
148,146,1: CIRCLE 152,146,1: PLO
T 150,143: PLOT 149,141: DRAW 3,
0
9320 PLOT 150,138: DRAW 0,-19: P
LOT 142,89: DRAW 3,2: DRAW 0,25:
 DRAW 5,3: DRAW 5,-3: DRAW 0,-25
 : DRAW 3,-2
9330 PLOT 125,138: DRAW 10,-12:
DRAW 10,10: DRAW 10,0: DRAW 4,-4
 : CIRCLE 162,128,5
9340 PLOT 145,133: DRAW 10,0: PL
OT 145,131: DRAW 10,0: PLOT 145,
129: DRAW 10,0: PLOT 145,127: DR
AW 10,0: PLOT 145,125: DRAW 10,0
 : PLOT 146,123: DRAW 8,0
9350 PLOT 80,105: DRAW 136,0
9360 RESTORE 9300
9370 DATA 6,2,2,15,"Skeleton"
9390 RETURN
9400 REM killer bat
9410  CIRCLE 150,150,5: PLOT 148
,151: PLOT 152,151: PLOT 147,144
 : DRAW 6,0,-PI: PLOT 154,153: DR
AW 0,4: DRAW -3,-5: PLOT 146,153
 : DRAW 0,4: DRAW 3,-5
9420 PLOT 145,150: DRAW -20,0: D
RAW 8,-8,PI/2: DRAW 6,-6,PI/2: D
RAW 12,-15: DRAW 12,15: DRAW 6,6
,PI/2: DRAW 8,8,PI/2: DRAW -20,0
9430 PLOT 142,125: DRAW 5,15: PL
OT 153,140: DRAW 5,-15: PLOT 80,
105: DRAW 136,0
9440 RESTORE 9400
9450 DATA 3,1,3,10,"bat"
9490 RETURN
9500 REM Zombie
9510 CIRCLE 150,150,7: CIRCLE 14
8,152,1: CIRCLE 152,152,1: CIRCL
E 150,147,2
9520 PLOT 145,144: DRAW -25,15,P
I/6: DRAW -7,-7: DRAW 6,3: DRAW
25,-15,-PI/6: DRAW 0,-20: DRAW -
10,-10: DRAW 0,-15: DRAW -3,-1:
DRAW 8,0: DRAW 0,15: DRAW 11,10
9530 PLOT 150,120: DRAW 0,-18: D
RAW 6,-6: DRAW 5,0: DRAW -6,6: D
RAW 0,38: DRAW 25,15,-PI/6: DRAW
 6,-3: DRAW -7,7: DRAW -25,-15,P
I/6
9540 PLOT 80,105: DRAW 53,0: PLO
T 139,105: DRAW 10,0: PLOT 155,1
05: DRAW 61,0
9550 RESTORE 9500
9560 DATA 10,1,1,15,"Zombie"
9570 RETURN
9600 REM Rockman
9610 CIRCLE 140,120,20: PLOT 145
,110: DRAW -10,3,PI/4: DRAW 10,-
3,PI: CIRCLE 135,123,4: CIRCLE 1
37,122,1: CIRCLE 150,118,5: CIRC
LE 152,115,1
9620 PLOT 123,120: DRAW -10,-10:
 DRAW 10,-10: PLOT 160,120: DRAW
 5,3: DRAW 3,12
9630 PLOT 80,105: DRAW 48,0: PLO
T 154,105: DRAW 62,0
9650 RESTORE 9600
9660 DATA 8,1,1,10,"Rockman"
9670 RETURN
9700 REM goblin
9710 CIRCLE 150,130,5: CIRCLE 15
5,115,2: CIRCLE 155,115,6
9720 PLOT 149,131: PLOT 152,131:
 PLOT 149,128: DRAW 2,0
9730 PLOT 147,126: DRAW 0,-16,PI
 : DRAW 20,20: DRAW -20,-16: DRAW
 -2,8,-PI/2
9740 PLOT 153,125: DRAW 3,-4: PL
OT 144,111: DRAW -1,-20,PI/3: DR
AW 3,0: DRAW 4,17,-PI/3: DRAW 4,
-17,-PI/3: DRAW 3,0: DRAW -1,18,
PI/3
9750 RESTORE 9700
9760 PLOT 80,105: DRAW 61,0: PLO
T 148,105: DRAW 3,0: PLOT 159,10
5: DRAW 56,0
9770 DATA 5,2,3,10,"Goblin"
9780 RETURN
```



```
   1 REM E RND?■ TAN
   2 REM
   3 REM       BANK ROBBER
   4 REM     BY TIM MARTIN
   5 REM        DATA(C)
   6 REM        14/9/83
   7 REM
   8 REM
   9 GOTO 9020
  10 DIM A$(8,64)
  11 POKE 16418,0
  20 LET A$(1)="■( )■( ■()■(■( ■()■()■()"
  30 LET A$(2)="■( )■( )■()■■)■)■( )■"
  40 LET A$(3)="■(■( )■( ■■( )■( )■()■"
  50 LET A$(4)="()■ )■( )■()■( )■ )■()■"
  60 LET A$(5)="■( ■( )■()■( ■( )■( ■"
  70 LET A$(6)="■( )■()■( )■ )■()■( )■"
  80 LET A$(7)="+  ++ +   + +++ +  ++ +  ++ +"
  90 LET A$(8)="  + ++   +  ++ + +++ ++  + ++"
 100 PRINT AT 0,0;"   SCORE   ££££££££££   LIVES   ";AT 1,0;"00000   +BANK+   5   ";AT 2,0;"   ";AT 3,0;"   "
 110 PRINT AT 5,0;"   ";AT 7,0;"   ";AT 19,0;"   ";AT 20,0;"   ";AT 21,0;"   ";AT 22,0;"   "
 120 FOR N=9 TO 17 STEP 2
 130 PRINT AT N,0;"--------------------------------"
 140 NEXT N
 150 LET S=0
 160 LET MF=0
 165 LET A=0
 170 LET DF=0
 175 LET B=0
 180 LET X=20
 185 LET MG=0
 190 LET Y=INT (RND*16)+8
 195 LET L=5
 200 FOR N=1 TO 32
 210 LET M=33-N
 220 PRINT AT 4,0;A$(7,N TO N+31);AT 6,0;A$(8,M TO M+31);AT 8,0;A$(1,N TO N+31);AT 10,0;A$(2,M TO M+31);AT 12,0;A$(3,N TO N+31);AT 14,0;A$(4,M TO M+31);AT 16,0;A$(5,N TO N+31);AT 18,0;A$(6,M TO M+31)
 226 IF X=0 OR X=2 OR X=20 THEN PRINT AT X,Y;"■"
 230 IF RND<.6 AND DF=0 THEN LET DF=1
 240 IF RND>.5 AND DF=1 THEN LET DF=0
 250 IF DF=0 THEN PRINT AT 2,0;"          ■■■■          "
 260 IF DF=1 THEN PRINT AT 2,0;"          ■■■■          "
 265 LET I$=INKEY$
 270 LET B=0+(I$="8" AND Y<30)-(I$="5" AND Y>0)
 290 IF I$="5" OR I$="8" THEN LET A=0
 300 LET A=2*(I$="6" AND MF=1)-2*(I$="7" AND MF=0)
 320 IF I$="7" OR I$="6" THEN LET B=0
 330 IF X>4 THEN GOTO 370
 340 PRINT AT X+A,Y+B;
 350 LET P=USR 16514
 360 IF P=136 OR P=137 THEN GOTO 380
 365 IF P=140 AND MF=1 THEN GOTO 380
 370 LET X=X+A
 375 LET Y=Y+B
 380 PRINT AT X,Y;
 390 LET P=USR 16514
 400 PRINT "■"
 410 IF P=0 OR P=16 OR P=17 THEN GOTO 700
 420 IF P=151 AND MF=1 THEN LET S=S-(INT (RND*5)+5)
 430 IF P=140 THEN GOTO 500
 435 IF P=44 THEN GOTO 600
 436 IF MF=0 THEN GOTO 440
 437 IF MF=1 AND X=(Z*2+6) THEN GOTO 800
 440 LET A=0
 445 LET B=0
 450 NEXT N
 460 GOTO 200
 500 LET MF=1
 505 LET MG=MG+1
 510 LET S=100
 520 LET Z=INT (RND*3)+1
 530 LET Z=Z*2
 550 LET A$(Z,11)="G"
 555 LET A$(Z,43)="G"
 570 GOTO 435
 600 LET SC=SC+S
 601 LET S$=STR$ SC
 602 PRINT AT 1,8-LEN S$;S$
 604 IF MG=10 THEN GOTO 1000
 605 LET A$(Z,11)=" "
 610 LET A$(Z,43)=" "
 620 LET X=20
 626 LET MF=0
 630 GOTO 440
 700 LET L=L-1
 701 FOR F=1 TO 20
 702 NEXT F
 703 PRINT AT 1,26;L
 705 IF L=0 THEN GOTO 9510
 710 LET X=20
 720 LET Y=16
 730 IF MF=0 THEN GOTO 440
 740 LET MF=0
 750 LET A$(Z,11)=" "
 760 LET A$(Z,43)=" "
 770 GOTO 440
 800 PRINT AT X-2,0;"                                ";AT X,Y;"■"
 805 FOR Z=0 TO Y-1
 810 PRINT AT X-2,Z;"■(:)"
 811 FOR N=0 TO 3
 812 NEXT N
 820 PRINT AT X-2,Z;"■( )"
 821 FOR N=0 TO 3
 822 NEXT N
 830 NEXT Z
 840 PRINT AT X-1,Z+1;"■"
 850 FOR N=1 TO 10
 860 NEXT N
 865 PRINT AT X-1,Z+1;"■";AT X,Y;"■"
 870 FOR Z=Y-1 TO 28
 880 PRINT AT X-2,Z;"■(:)"
 881 FOR N=0 TO 3
 882 NEXT N
 890 PRINT AT X-2,Z;"■( )"
 891 FOR N=0 TO 3
 892 NEXT N
 895 NEXT Z
 896 PRINT AT 21,4;"YOU HAVE BEEN ARRESTED..."
 897 FOR N=0 TO 50
 898 NEXT N
 899 GOTO 9510
1000 IF SC/1000=INT (SC/1000) THEN LET L=L+1
1010 GOTO 701
8999 STOP
9000 CLEAR
9005 CLS
9010 SAVE "BANK ROBBER"
9500 CLS
9502 SLOW
9505 LET SC=0
9506 LET H=0
9510 LET S$=STR$ SC
9511 CLS
9515 IF SC>H THEN LET H=SC
9517 LET H$=STR$ H
9518 PRINT AT 0,8;"BANK ROBBER ■";AT 2,9;"DATA (C) 9/82"
9520 PRINT AT 4,0;"   SCORE 00000   HIGH 00000   "
9530 PRINT AT 4,15-LEN S$;S$;AT 4,28-LEN H$;H$
9540 PRINT AT 6,6;"■ LEFT";AT 8,6;"■ DOWN";AT 10,6;"■ UP";AT 12,6;"■ RIGHT"
9550 PRINT AT 18,4;"PRESS ANY KEY TO PLAY"
9552 FOR N=1 TO 20
9555 NEXT N
9560 IF INKEY$="" THEN GOTO 9560
9570 CLS
9580 LET SC=0
9999 GOTO 10
```

PENETRATE the security of New York's biggest bank in **Manhattan Caper** by Tim Martin of Reading, Berkshire, for the 16K ZX-81.

Actually, the bank is dead easy to rob, it's the hair-raising traffic of downtown Manhattan which causes the problems. You'll have to cross six lanes of a very busy road to reach the bank, and then make your way back again to the getaway car. If you are not careful pedestrians may spill your loot, and you should watch out for the police car.

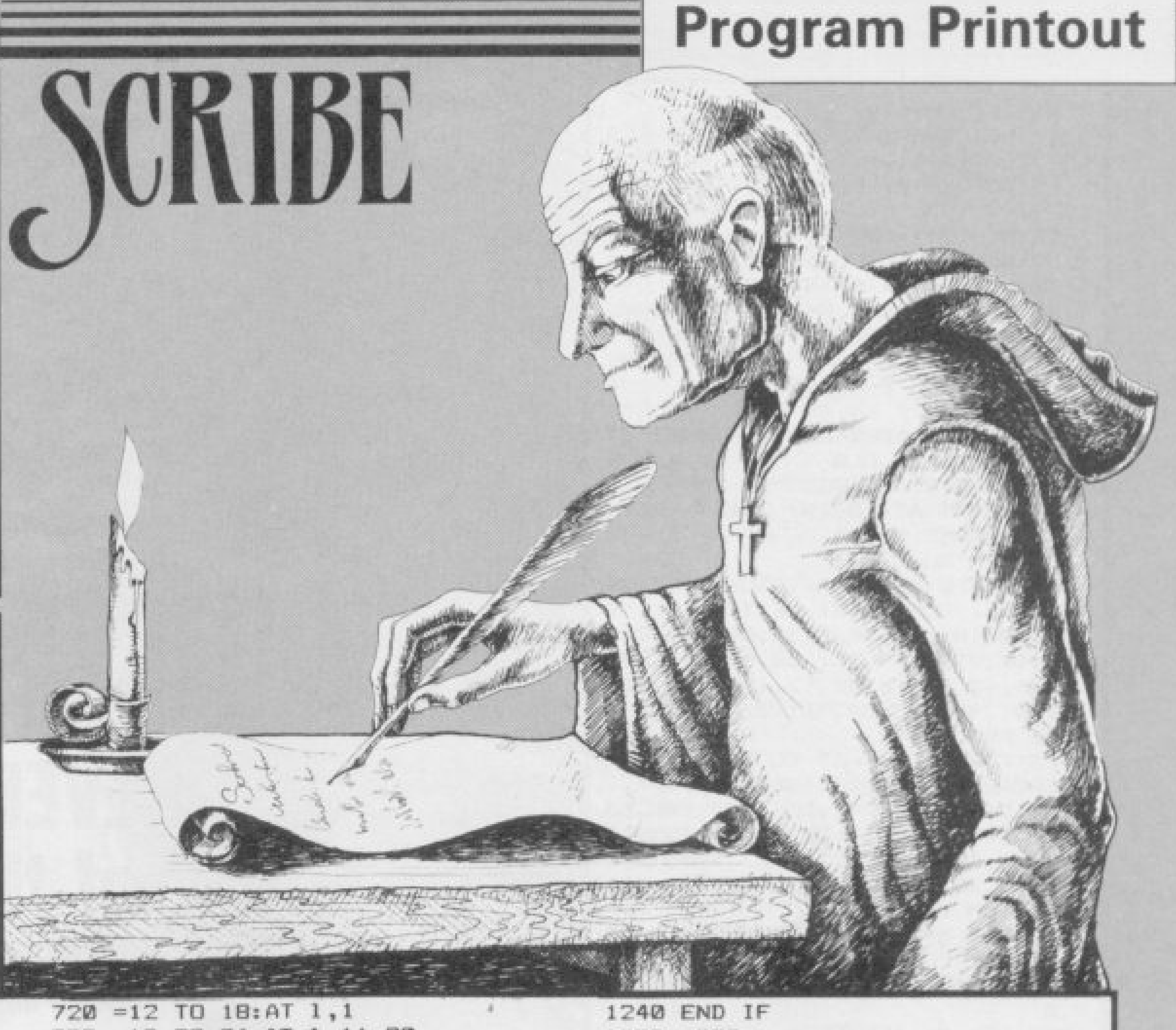
There is a short machine code routine in the initial REM statement. RND and TAN are the functions of these names, and the question-mark is the character with code 78. To get it into the statement, put in an X initially and then POKE 16517,78 which should produce the question-mark instead. Do not use an ordinary question-mark, as it is not the same.

Manhattan Caper



Program Printout

SCRIBE

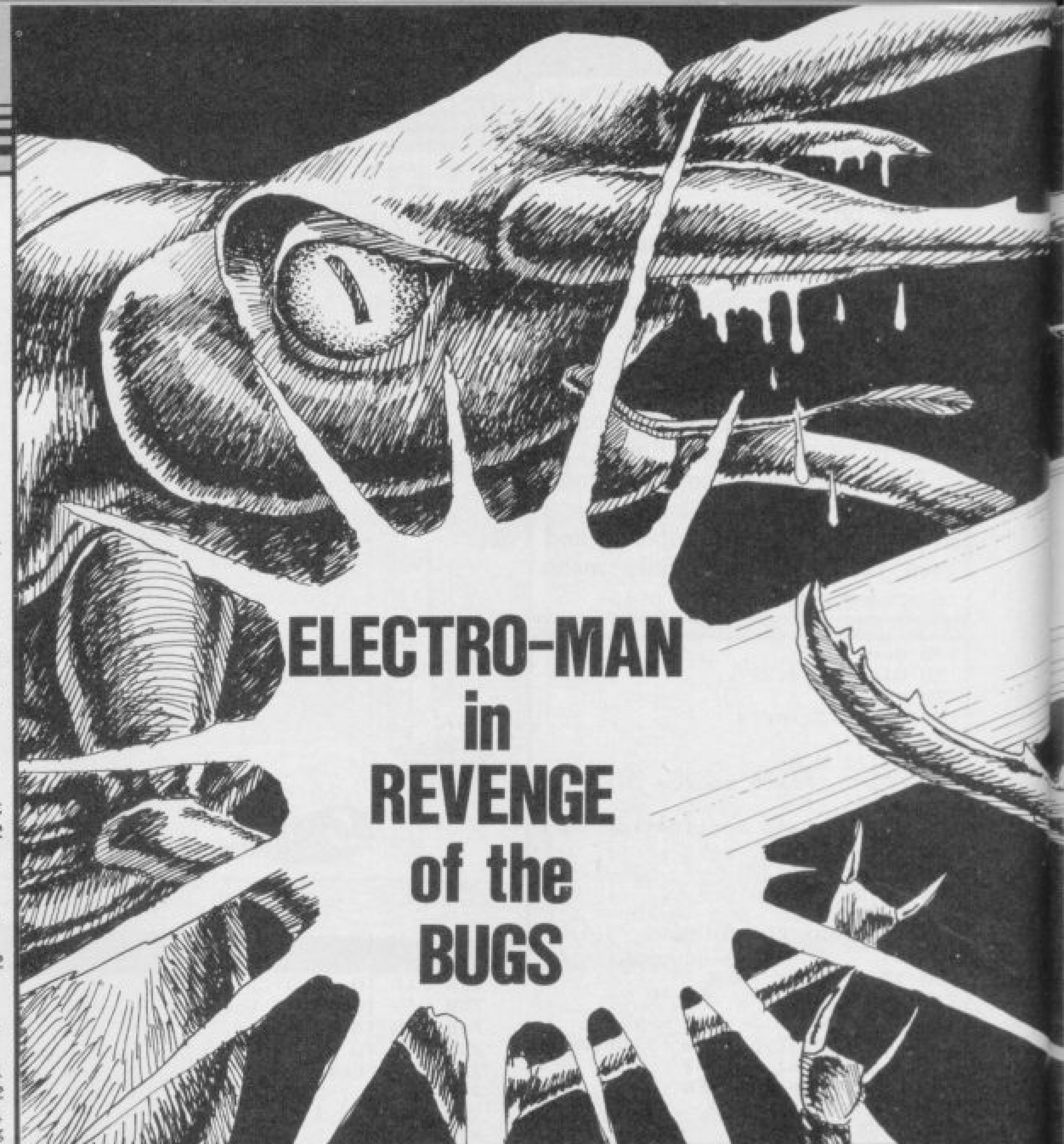


BACK-UP your QL programs the easy way with **Scribe** by David Titterington of West Bradford in Lancashire.

The program will ask you to place the cartridges to be copied in the appropriate drives and then gives you a choice. You can copy the lot, or select particular files using the cursor. You do not need to format the new cartridge in advance; you can therefore add programs to an existing selection.

Remember that copying commercial programs is illegal, unless sanctioned by the company, and even then you must only make copies for your personal use.

```
100 num=3
110 DIM a$(70,20)
120 k=0
130 PAPER 3:INK 4
140 MODE 4
150 CSIZE 2,0
160 PRINT "Place source Cartridg
e in MDV1_,"
170 PRINT\\"and Destination Cart
ridge in MDV2_."
180 CSIZE 0,0
190 REPeat ask1
200 CLS#0
210 INPUT#0;"FORMAT MDV2_ (y/n)
? ";c$
220 IF c$=="y" THEN
230 REPeat ask2
240 CLS#0
250 INPUT#0;"Type New Filename (
Max 8 Letters) ? ";d$
260 IF LEN(d$)>8 THEN
270 END REPeat ask2
280 ELSE
290 REPeat loop3
300 FORMAT "mdv2_"&d$
310 CLS#0
320 END IF
330 REPeat ask6
340 CLS#0
350 INPUT#0;"REPEAT FORMAT (y/n)
";f$
360 IF f$=="n" THEN EXIT loop3
370 IF f$=="y" THEN
380 END REPeat loop3
390 ELSE
400 END REPeat ask6
410 END IF
420 ELSE
430 IF c$=="n" THEN EXIT ask1
440 END REPeat ask1
450 END IF
460 CLS#0
470 PRINT#0;"PLEASE WAIT, GETTIN
G DIRECTORY"
480 OPEN_NEW#3,mdv2_12345678
490 DIR#3,mdv1_
500 CLOSE#3
510 OPEN#3,mdv2_12345678
520 REPeat loop
530 IF NOT EOF(#3) THEN
540 k=k+1
550 INPUT#3;a$(k)
560 IF a$(k)="12345678" THEN k=k
-1
570 ELSE
580 EXIT loop
590 END IF
600 END REPeat loop
610 CLS
620 CLOSE#3:DELETE mdv2_12345678
630 DIM e(k-2)
640 CSIZE 2,0
650 UNDER 1
660 PRINT "Cartridge name : "!a$
(1)\a$(2)
670 UNDER 0
680 CSIZE 0,0
690 FOR l=3 TO k
700 SELect ON l
710 =3 TO 11:AT l,2
720 =12 TO 18:AT l,1
730 =19 TO 34:AT l-16,20
740 =35 TO 50:AT l-32,39
750 =51 TO 66:AT l-48,58
760 END SELect
770 PRINT l-2!"-"!a$(l)
780 END FOR l
790 CLS#0
800 PRINT#0;"SPACE-BAR - BACK-UP
 ALL MDV1_."
810 PRINT#0;"ENTER      - BACK-UP
 part."
820 PRINT#0;"ESCape     - ABORT."
830 REPeat l
840 m=CODE(INKEY$)
850 SELect ON m
860 =27
870 CLS#0:rerun
880 =32
890 FOR n=1 TO k-2:e(n)=1
900 backup
910 END REPeat ask3
920 =10
930 selectcopies
940 END SELect
950 END REPeat l
1000 DEFine PROCedure selectcopi
es
1010 x=0
1020 y=3
1030 CLS#0
1040 PRINT#0;"Move Cursor - ARRO
W KEYS."\"ENTER       - COPY FIL
E.";
1050 PRINT#0;" ( Repeat to remov
e a FILE from BACK-UP LIST )."
1060 PRINT#0;\"HIT F1 WHEN FINIS
HED"
1070 REPeat printloop
1080 y1=y:x1=x
1090 AT y,x
1100 PRINT "*"
1110 ch=CODE(INKEY$(#1))
1120 SELect ON ch
1130 =10
1140 AT y,x+6
1150 IF e(num-2)=0 THEN
1160 PAPER 7:INK 0
1170 PRINT a$(num)
1180 PAPER 0:INK 7
1190 e(num-2)=1
1200 num=num+1
1210 ELSE
1220 PRINT a$(num)
1230 e(num-2)=0
1240 END IF
1250 =208
1260 y=y-1
1270 num=num-1
1280 =216
1290 y=y+1
1300 num=num+1
1310 =232
1320 CLS#0
1330 PRINT#0;"HIT ANY KEY TO COM
MENCE BACKUP."
1340 AT y,x:PRINT " "
1350 PAUSE
1360 backup
1370 END SELect
1380 IF num<3 THEN num=3
1390 IF y<3 THEN y=3
1400 IF num>k THEN num=k
1410 SELect ON num
1420 =3 TO 18:x=0:y=num
1430 =19 TO 34:x=19:y=num-16
1440 =35 TO 50:x=38:y=num-32
1450 =51 TO 66:x=57:y=num-48
1460 END SELect
1470 AT y1,x1:PRINT " "
1480 END REPeat printloop
1490 END DEFine
2000 DEFine PROCedure backup
2010 CLS#0
2020 PRINT#0;"Backing up MDV1_ T
o MDV2_"
2030 OPEN#5,scr_100x22a220x230
2040 CLS#5
2050 INK#5,3
2060 BORDER#5,6,2,1
2070 FOR l=3 TO k
2080 IF e(l-2)=1 THEN
2090 COPY "mdv1_"&a$(l) TO "mdv2
_"&a$(l)
2100 ELSE
2110 END IF
2120 AT#5,0,0
2130 PRINT#5;l-2!"out of"!k-2
2140 END FOR l
2150 CLOSE#5
2160 rerun
2170 END DEFine
3000 DEFine PROCedure rerun
3010 AT#0,0,0:PRINT#0;"RUN AGAIN
 (y/n) ?        "
3020 AT#0,0,18:INPUT#0;g$
3030 IF g$=="y" THEN RUN
3040 IF g$=="n" THEN STOP
3050 rerun
3060 END DEFine
```



ELECTRO-MAN in REVENGE of the BUGS

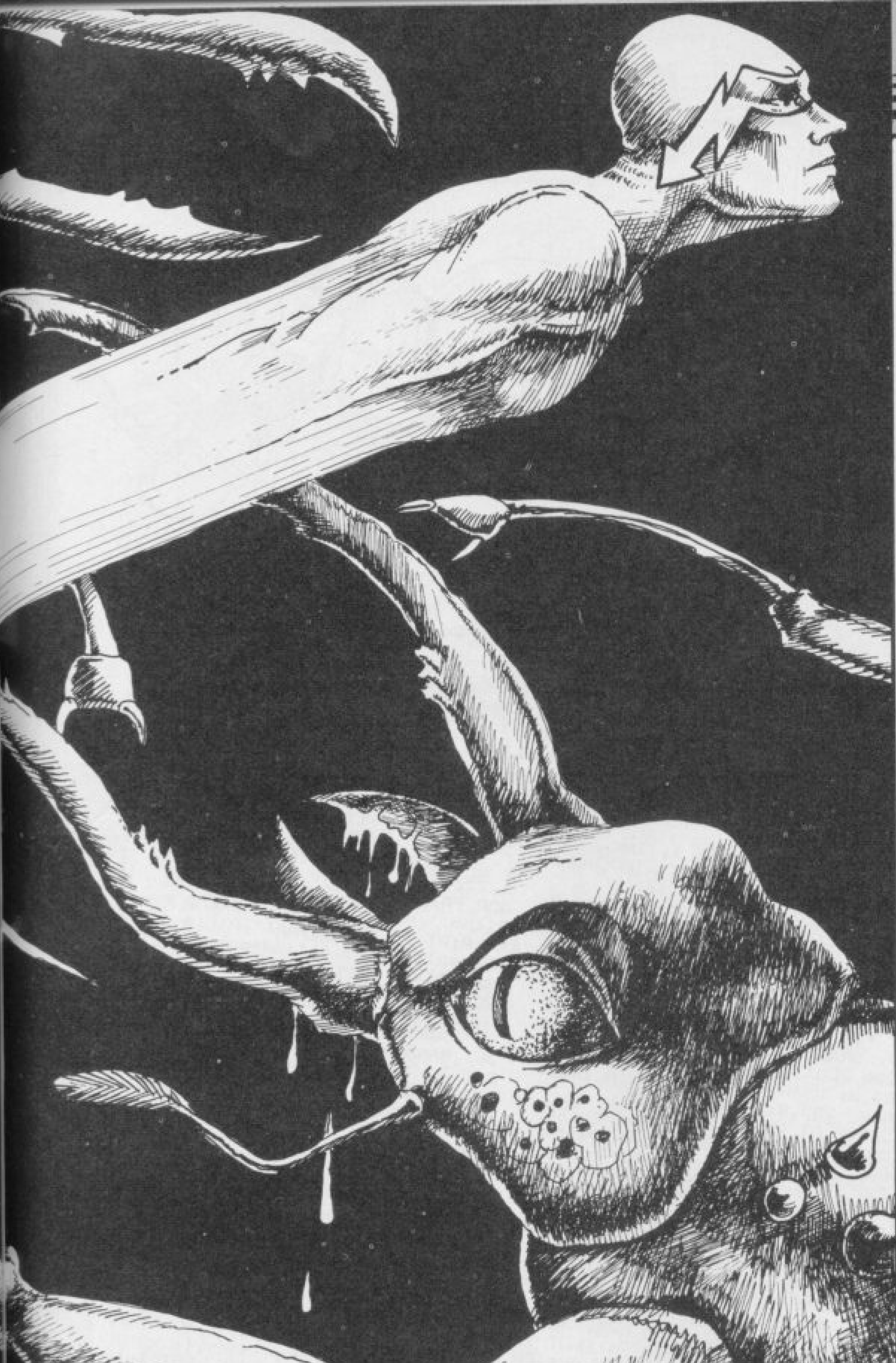
THRILL to the mysterious powers of Electro-Man. SHUDDER at the awesome ugliness of the Bugs. REJOICE as the forces of good overcome the evil supervillains yet again.

Electro-Man in Revenge of the Bugs is an all-action game by Paul Bailey of Rotherham, South Yorkshire for any Spectrum. Electro-Man has planted a time-bomb to destroy the Bugs, but has been trapped. He uses his special power to turn himself into a laser beam, and must avoid the Bugs until the bomb explodes.

The game is compatible with Currah Microspeech. If you do not have the product, omit lines 65, 315, 1070 and 2170.

The program uses our special abbreviations for graphics characters, so please read the instructions on the first page of Program Printout before entering the listing.

```
   1 LET keys=0
   2 LET BUG=1
   3 LET C=1
   5 BORDER 0: PAPER 0: INK 5: C
LS
  10 REM ***************
  20 REM *ELECTRO - MAN*
  30 REM ***************
  40 REM          I N
  41 REM REVENGE OF THE BUGS
  42 REM
  50 REM1985 By Paul Bailey
  60 REM
  65 LET S$="PL(EE)S'W(AY)T"
  70 FLASH 0: CLS
  98 POKE 23658,255
  99 PRINT AT 10,10; INK 7; PAPE
R 1;"PLEASE WAIT"
 130 REM Bug 1
 140 FOR g=USR "C" TO USR "F"+7:
 READ d: POKE g,d: NEXT g
 150 DATA 129,247,236,89,60,63,1
20,112,129,239,55,154,60,252,30,
14,96,40,31,15,30,12,116,240,6,1
2,248,240,123,54,46,28
 160 REM Bug 2
 170 FOR g=USR "G" TO USR "J"+7:
 READ d: POKE g,d: NEXT g
 180 DATA 121,247,236,153,188,63
,127,113,158,239,55,153,61,252,2
54,142,102,63,31,15,222,108,116,
56,102,252,248,240,120,48,46,15
 220 REM Barrier
 230 FOR g=USR "N" TO USR "N"+7:
 READ d: POKE g,d: NEXT g
 240 DATA 0,0,129,195,195,195,12
9,0
 250 REM Mr.'CRASH'!
 260 FOR g=USR "O" TO USR "T"+7:
 READ d: POKE g,d: NEXT g
 270 DATA 199,255,91,61,35,117,1
21,255,129,231,255,255,255,219,2
55,255,227,255,218,188,196,174,1
58,255,202,234,96,106,106,254,63
,7,170,170,0,0,170,170,255,255,1
63,167,6,166,166,190,252,224
 271 FOR G=USR "U" TO USR "U"+7:
 READ D: POKE G,D: NEXT G
 272 DATA BIN 01111110,BIN 11111
111,BIN 11111111,BIN 11111111,BI
N 11111111,BIN 11111111,BIN 1111
1111,BIN 01111110
 280 PAPER 0: BORDER 0: INK 5: C
LS
 281 LET D=1: BORDER 0: PAPER 0:
 INK 5
 290 FLASH 1: INK 6: LET A$="ELE
CTRO - MAN": GO SUB 400: FLASH 0
 300 LET A$="I N": GO SUB 400
 310 INVERSE 1: LET A$="REVENGE
OF THE BUGS": GO SUB 400: INVERS
E 0: INK 5
 315 LET S$="D(OUU)'Y(OUU)'WONT'
INSTRC(SH)uNS"
 320 LET A$="DO YOU WANT INSTRUC
TIONS? Y/N": GO SUB 400: PAUSE 0
: LET D$=CHR$ (PEEK 23560): IF D
$="N" THEN  GO TO 500
 330 CLS : LET D=1: PRINT : LET
A$="I N S T R U C T I O N S": GO
 SUB 400
 340 LET A$="You take the part o
f ELECTRO MAN": GO SUB 400
 341 LET A$="who has the power t
o change into": GO SUB 400
 342 LET A$="anything he likes.H
is mission is": GO SUB 400
 343 LET A$="to destroy the bugs
 in the": GO SUB 400
 344 LET A$="national defence co
nputer": GO SUB 400
 356 LET A$="For this mission he
 has changed": GO SUB 400
 357 LET A$="into a laser which
you control": GO SUB 400
 359 FLASH 1: INK 7: BRIGHT 1: L
ET A$="ANY KEY TO GO ON": GO SUB
 400: PAUSE 0: FLASH 0: CLS : LE
T D=1
 360 LET A$="C O N T R O L S": G
O SUB 400
 361 INK 6: LET A$="Q------LEFT"
: GO SUB 400
 362 LET A$="W------RIGHT": GO S
UB 400
 363 LET A$="L------DOWN": GO SU
B 400
 364 LET A$="P------UP": GO SUB
400
 365 LET D=D-1: LET A$="DON'T TO
UCH ANYTHING AT ALL ON": GO SUB
400: LET A$="THE SCREEN OR YOU W
ILL DIE!": LET D=D-1: GO SUB 400
: INK 5: LET A$="There is a time
 bomb in the": GO SUB 400
 366 LET A$="centre of the scree
n.When it": GO SUB 400
 367 LET A$="explodes it will ki
ll the bugs": GO SUB 400
 370 FLASH 1: INK 7: BRIGHT 1: L
ET A$="PRESS ANY KEY TO PLAY": G
O SUB 400: FLASH 0: PAUSE 0: GO
TO 500
 400 LET X=LEN (A$): LET X=INT (
32-X)/2
 410 FOR G=1 TO LEN A$: BEEP .00
4,6
 420 PRINT AT D,X+G-1;A$(G TO G)
: NEXT G: LET D=D+2: RETURN
 430 REM ***************
 440 REM
 500 INK 5: PAPER 0: BORDER 0: C
LS : REM   VARIABLES
 510 LET SC=0: LET MEN=3: LET TM
=20: LET BO=TM
 520 DIM H$(2,2): DIM L$(2,2)
 530 LET H$(1)="CD": LET H$(2)="
GH"
 540 LET L$(1)="EF": LET L$(2)="
IJ"
 550 LET X=240: LET Y=88
 560 LET H=-3: LET V=-3: DIM M(2
): LET M(1)=16: LET M(2)=16
 580 LET BUG=1
 600 REM    SCREEN
 610 PLOT 252,8: DRAW 0,167: PLO
T 254,8: DRAW 0,166: PLOT 2,8: D
RAW 95,0: DRAW 26,30: DRAW 20,0:
 DRAW 26,-30: DRAW 84,0: DRAW 0,
166: DRAW -84,0: DRAW -26,-30: D
RAW -20,0: DRAW -26,30: DRAW -95
,0: DRAW 0,-166
 615 PRINT AT 21,0;"(32*ig8)"
 617 PRINT AT 21,0;"(32*ig8)"
 620 FOR G=-10 TO 7: FOR K=1 TO
```



```
5: BEEP .003,G+H: NEXT K: NEXT G
 630 PRINT AT 9,15; INK 7; BRIGH
T 1;"(g4,ig8,ig8,ig7)"
 640 PRINT AT 10,15; INK 7; BRIG
HT 1;"(g5)"; INVERSE 1;TM; INVER
SE 0;"(ig5)"
 650 PRINT AT 11,15; INK 7; BRIG
HT 1;"(g1,ig8,ig8,g2)"
 660 LET O=-2: LET P=2
 700 REM    MAIN LOOP
 710 FOR A=1 TO 2: PLOT  INK 4;X
,Y: BEEP .002,0: BEEP .002,-4
 711 FOR Z=1 TO 6: PLOT  INK 4;X
,Y: BEEP .002,0: BEEP .002,-4
 720 LET HIT=POINT (X+H,Y+V): IF
 HIT=1 THEN  GO TO 2000
 725 LET HIT=POINT (X+H,Y+V-V):
IF HIT=1 THEN  GO TO 2000
 726 LET HIT=POINT (X+H,Y+V-(V-1
)): IF HIT=1 THEN  GO TO 2000
 730 REM   KEYBOARD INPUT
 740 LET N=PEEK (23560)
 750 LET J=H: LET H=0: LET H=H-(
N=81)+(N=87): IF H=0 THEN  LET H
=J
 760 LET J=V: LET V=0: LET V=V-(
N=76)+(N=80): IF V=0 THEN  LET V
=J
 762 LET H=H+(H=1)-(H=-1)
 764 LET V=V+(V=1)-(V=-1)
 770 LET x=X+H: LET Y=Y+V
 771 LET T=INT (RND*10)+1: REM
       BIG  BUG
 772 IF T>7 THEN  PRINT AT 9,25;
"(3*sp)";AT 10,25;"(3*sp)": PRIN
T AT 9,2; INK 6; BRIGHT 1;"OPQ";
AT 10,2;"RST": BEEP .002,40: BEE
P .002,50: BEEP .002,60
 773 IF T<3 THEN  PRINT AT 9,2;"
(3*sp)";AT 10,2;"(3*sp)": PRINT
AT 9,25; INK 6; BRIGHT 1;"OPQ";A
T 10,25;"RST": BEEP .002,40: BEE
P .002,50: BEEP .002,60
 775 NEXT Z
 780 REM   MOVE BUGS
 790 BEEP .001,10: BEEP .001,20:
 PRINT AT 14,M(1);"(2*sp)"; INK
3;H$(BUG);"(2*sp)": PRINT AT 15,
M(1);"(2*sp)"; INK 3;L$(BUG);"(2
*sp)"
 800 BEEP .001,-10: BEEP .001,-2
0: PRINT AT 5,M(2);"(2*sp)"; INK
 6;H$(BUG);"(2*sp)": PRINT AT 6,
M(2);"(2*sp)"; INK 6;L$(BUG);"(2
*sp)"
 810 IF BUG=1 THEN  LET BUG=2: G
O TO 830
 820 LET BUG=1
 830 LET M(1)=M(1)+O: LET M(2)=M
(2)+P
 840 IF M(1)<10 THEN  LET O=2
 850 IF M(1)>17 THEN  LET O=-2
 860 IF M(2)<10 THEN  LET P=2
 870 IF M(2)>17 THEN  LET P=-2
 880 PRINT AT 10,16; INK 7; BRIG
HT 1; INVERSE 1;"(2*sp)"
 885 PRINT AT 10,16; INK 7; BRIG
HT 1; INVERSE 1;TM
 890 PRINT AT 21,1; PAPER 2; INK
 6;"SCORE=";SC;"(3*sp)";"LIVES="
;MEN
 895 BEEP .002,40: LET L=INT (RN
D*12)+5: LET Q=INT (RND*29)+2
 896 IF ATTR (L,Q)=71 THEN  GO T
O 895
 897 PRINT AT L,Q; INK 4; FLASH
1;"(ig6)"
 900 NEXT A: LET SC=SC+5: LET TM
=TM-1: BEEP .01,-2: IF TM>0 THEN
  GO TO 700
 999 REM   EXPLODE!
1000 DIM B$(3,4): LET B$(1)="(g4
,ig6,ig7,g7)": LET B$(2)="(ig3,i
g4,ig8,g6)": LET B$(3)="(ig2,ig6
,g7,g6)"
1005 PRINT AT 7,15; INK 5;"BONUS
";BO*10
1006 LET SC=SC+BO*10
1011 FOR G=1 TO 20: FOR J=1 TO 3
1020 LET F=INT (RND*3)+1: LET K=
INT (RND*-5)+-10
1030 BEEP .003,K+10: PRINT AT 8+
J,15;B$(F)
1040 NEXT J: NEXT G
1050 PAUSE 150: CLS
1060 PRINT AT 2,15; INK 4;"OPQ";
AT 3,15; INK 4;"RST"
1070 LET S$="(II)(LL)'GET'Y(OUU)
'(DTH)IS'T(II)M'ILECTR(OO)MAN"
1075 LET D=16
1080 PRINT : PRINT : LET A$="I'L
L GET YOU THIS TIME !": GO SUB 4
00
1090 PRINT : PRINT
1110 INK 6: LET A$="GET READ FOR
 NEXT LEVEL!": GO SUB 400: INK 5
1120 PAUSE 0: CLS : LET X=240: L
ET Y=88: LET H=-2: LET V=2: LET
TM=BO+5: GO TO 580
2000 LET X=240: LET Y=88: REM
       LIVE LOST
2010 FOR J=40 TO -5 STEP -1
2020 BEEP .04,J: BORDER INT (RND
*7)+1: NEXT J
2025 LET MEN=MEN-1
2030 BORDER 0: CLS
2040 FLASH 1: FOR G=0 TO 21
2045 LET X$="(g7,ig7,g7,ig7,g7,i
g7,g7,ig7,g7,ig7,g7,ig7,g7,ig7,g
7,ig7,g7,ig7,g7,ig7,g7,ig7,g7,ig
7,g7,ig7,g7,ig7,g7,ig7,g7,ig7)"
2050 PRINT  PAPER 2; INK 6; BRIG
HT 1;X$: NEXT G
2060 FLASH 0: PRINT AT 9,7;"OH N
O!,YOU CRASHED!"
2070 IF MEN>0 THEN  PRINT AT 11,
10;"LIVES LEFT ";MEN
2080 IF MEN=0 THEN  PRINT AT 11,
11;"GAME OVER": GO TO 2100
2090 PAUSE 0: LET H=-2: LET V=-2
: CLS : GO TO 580
2100 REM    R . I . P
2105 PAUSE 0
2110 CLS : PRINT : PRINT
2120 PRINT TAB 12;"(3*sp,ig8)"
2130 PRINT TAB 12;" R.I.P "
2140 FOR G=1 TO 6: PRINT TAB 12;
"(3*sp,ig8)": NEXT G
2150 PRINT : PRINT
2160 PRINT  INK 6;"(8*sp)YOUR SC
ORE WAS :";SC: PRINT : PRINT "(1
3*sp)OPQ": PRINT "(13*sp)RST"
2170 LET S$="PRES'EN(EE)'K(EE)'T
(OUU)'PL(AY)"
2180 PRINT : PRINT "(8*sp)PRESS
ANY KEY TO PLAY": PAUSE 0: GO TO
 280
3000 REM   END  OF  PROG.
```

RIFLE RANGE



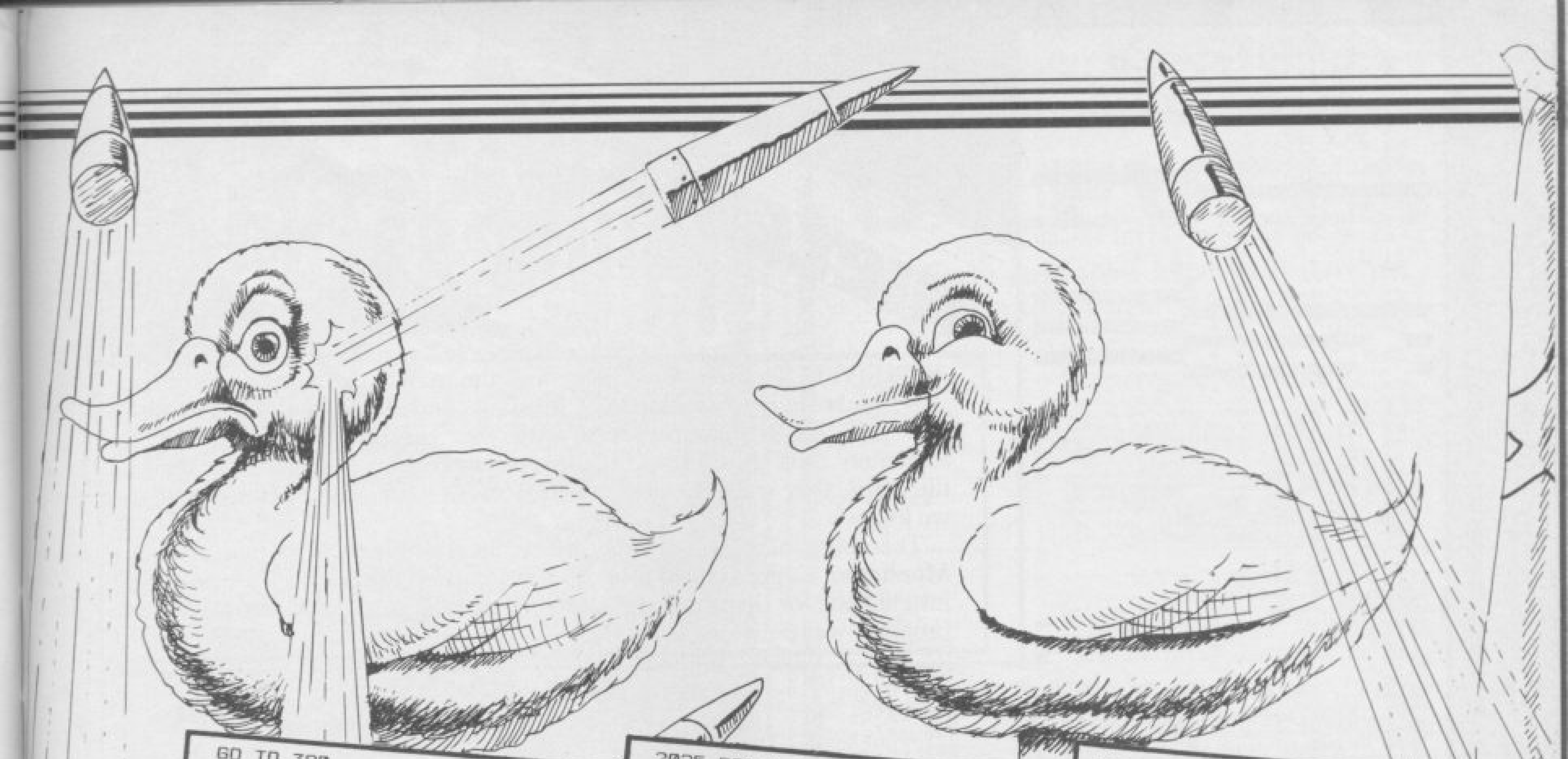
CRACK SHOTS should have no trouble with **Rifle Range** by Michael Housley of Bradford, Yorkshire.

You must shoot as many targets as you can before your ammunition runs out. To make life more difficult your gun moves as well as the targets, and you will have to aim slightly in front to score.

The game gets progressively difficult, and there is a hi-score table included. Full instructions are provided and the game runs on a 48K Spectrum or Spectrum Plus.

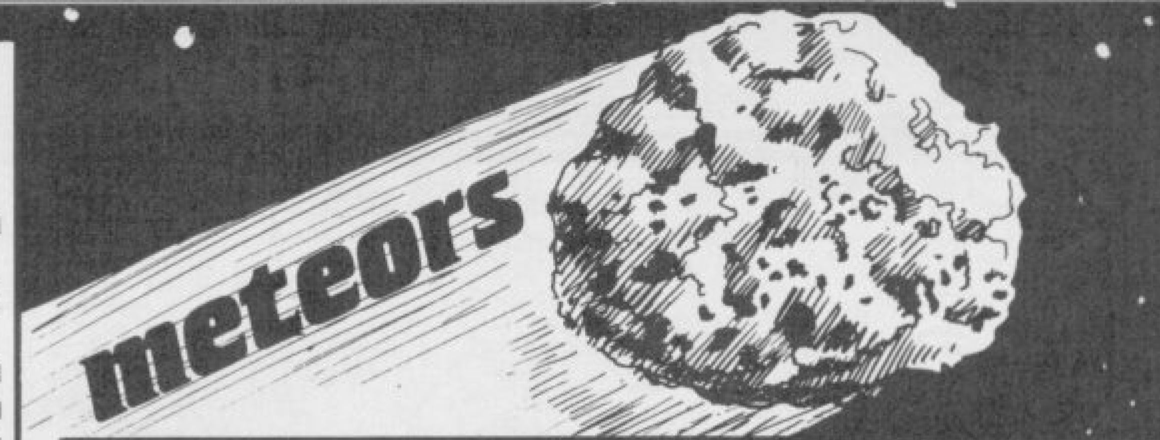
***Rifle Range** uses our special abbreviations for graphics characters, so please read the instructions on the first page of Program Printout before typing in the listing.*

```
  1 DATA 17,64,156,33,0,64,1,0,
27,237,176,201,17,0,64,33,64,156
,1,0,27,237,176,201,33,0,88,1,0,
3,197,62,0,1,100,0,11,60,211,254
,120,177,32,248,54,7,35,54,54,19
3,11,120,177,32,231,201,32,228,2
01
  2 FOR f=60000 TO 60011: READ
a: POKE f,a: NEXT f
  3 FOR f=60050 TO 60061: READ
a: POKE f,a: NEXT f
  4 FOR f=60100 TO 60134: READ
a: POKE f,a: NEXT f
  5 DIM h(5): DIM h$(5,10)
  6 FOR f=1 TO 5: LET h(f)=6000
-(f*1000): NEXT f
  7 FOR f=1 TO 5: LET h$(f)="SP
ECTRUM": NEXT f
  8 FOR f=60200 TO 60241: READ
a: POKE f,a: NEXT f: FOR f=60250
 TO 60266: READ a: POKE f,a: NEX
T f
  9 DATA 1,2,0,197,33,0,64,1,0,
4,126,15,119,35,126,7,119,35,11,
120,177,32,243,193,11,120,177,32
,1,201,33,0,80,120,177,197,1,0,4
,32,225,201,33,0,88,1,0,3,58,86,
234,119,35,11,120,177,32,246,201
  10 DATA 108,182,182,182,182,18
2,182,182,182,182,182,182,182,18
2,182,182,0,0,28,30,46,126,30,28
,60,62,31,31,15,15,7,3,31,124,25
2,252,248,248,240,224
  20 DATA 3,12,16,35,68,72,145,1
46,146,145,72,68,35,16,12,3,192,
48,8,196,34,18,137,73,73,137,18,
34,196,8,48,192
  30 DATA 1,1,1,3,3,3,31,255,255
,31,3,3,3,1,1,1,128,128,128,192,
192,192,248,255,255,248,192,192,
192,128,128,128
  40 DATA 15,16,36,42,68,64,127,
64,224,16,72,168,68,4,252,4,32,2
4,5,7,53,73,129,255,8,48,64,192,
56,36,2,254
  50 DATA 1,1,1,3,3,255,63,7,128
,128,128,192,192,255,252,224,7,1
5,14,28,56,112,224,192,224,240,1
12,56,28,14,7,3
  100 FOR f=0 TO 167: READ a: POK
E USR "a"+f,a: NEXT f
  150 PAPER 2: INK 0: BRIGHT 1: B
ORDER 2: CLS
  160 FOR f=0 TO 3: PRINT  PAPER
5;AT f,0;"(32*sp)": NEXT f
  170 FOR f=0 TO PI↑2 STEP .1: PL
OT  INK 6;235+SIN (f/PI)*14,160+
COS (f/PI)*14: DRAW  INK 6;-(((2
35+SIN (f/PI)*14)-235)*2),0: NEX
T f
  175 PLOT  INVERSE 1; PAPER 0; I
NK 6;225,156: DRAW  INVERSE 1; I
NK 6; PAPER 0;20,0,1.5: DRAW  IN
VERSE 1; PAPER 0; INK 6;-20,0,-.
75
  177 CIRCLE  INVERSE 1; INK 6; P
APER 0;232,162,3: PLOT  INVERSE
1; INK 6; PAPER 0;233,162
  178 CIRCLE  INVERSE 1; INK 6; P
APER 0;238,162,3: PLOT  INVERSE
1; INK 6; PAPER 0;237,162
  179 CIRCLE  INVERSE 1; INK 6; P
APER 0;235,157,2
  180 PLOT 0,0: FOR f=0 TO 15: PL
OT f,f: DRAW 15-f,0: PLOT 255-f,
-f: DRAW f-15,0: NEXT f
  200 PLOT 0,0: DRAW 48,48: DRAW
159,0: DRAW 48,-48: DRAW 0,140:
DRAW -255,0: DRAW 0,-140
  210 PLOT 48,48: DRAW 0,92: PLOT
207,48: DRAW 0,92: PLOT 16,16:
DRAW 223,0
  220 PLOT 10,10: DRAW 0,130: PLO
T 20,20: DRAW 0,120: PLOT 30,30:
 DRAW 0,110: PLOT 40,40: DRAW 0,
100
  230 PLOT 245,10: DRAW 0,130: PL
OT 235,20: DRAW 0,120: PLOT 225,
30: DRAW 0,110: PLOT 215,40: DRA
W 0,100
  240 PLOT 58,48: DRAW -24,-32: P
LOT 68,48: DRAW -14,-32: PLOT 78
,48: DRAW -9,-32: PLOT 88,48: DR
AW -5,-32
  250 PLOT 98,48: DRAW -4,-32: PL
OT 108,48: DRAW -3,-32: PLOT 118
,48: DRAW -2,-32: PLOT 128,48: D
RAW 0,-32
  260 PLOT 138,48: DRAW 2,-32: PL
OT 148,48: DRAW 3,-32: PLOT 158,
48: DRAW 4,-32: PLOT 168,48: DRA
W 5,-32
  270 PLOT 178,48: DRAW 9,-32: PL
OT 188,48: DRAW 14,-32: PLOT 198
,48: DRAW 24,-32
  280 PLOT 48,95: DRAW 159,0: DRA
W 10,-3: DRAW -179,0: DRAW 8,3:
PLOT 38,92: DRAW 0,-2: DRAW 179,
0: DRAW 0,2
  290 PLOT 0,140: DRAW 0,2: DRAW
255,0: DRAW 0,-2
  300 FOR f=67 TO 187 STEP 20: CI
RCLE  INK 7;f,106,10: CIRCLE  IN
K 7;f,106,7: NEXT f
  310 PRINT  PAPER 0; INK 7;AT 2,
6;"YE OLDE RIFLE RANGE."
  320 PLOT 45,149: DRAW 165,0: DR
AW 0,13: DRAW -165,0: DRAW 0,-13
  330 PLOT 80,149: DRAW 0,-6: PLO
T 82,149: DRAW 0,-6: PLOT 175,14
9: DRAW 0,-6: PLOT 173,149: DRAW
 0,-6
  340 PLOT 80,142: PLOT 82,142: P
LOT 175,142: PLOT 173,142
  345 PRINT  PAPER 2; INK 6;AT 5,
8;"C";AT 6,8;"DE";AT 5,22;"C";AT
 6,22;"DE"
  350 PRINT  PAPER 7;AT 5,11;"YE
PRIZES.";AT 11,12;"YE SCORE"; PA
PER 0;AT 12,13;"(6*sp)";AT 14,6;
"(20*sp)";AT 15,6;"(20*sp)"
  360 PRINT  PAPER 7;AT 0,11;"YE
AMMO "; PAPER 0;"(3*sp)": PRINT
 PAPER 0;AT 20,2;"(28*sp)";AT 21
,1;"(30*sp)"
  363 RANDOMIZE USR 60000
  365 GO TO 2000
  367 BORDER 0
  368 LET sc=0: LET bon=1000: LET
 tam=51
  369 RANDOMIZE USR 60050
  370 LET co=0: LET a=15: LET f=0
: LET x=1: LET am=tam: LET go=10
00
  375 PRINT  PAPER 0; INK 6;AT 0,
19;am
  380 GO SUB go
  390 LET f=0: LET am=am-1
  400 PRINT  PAPER 0; INK 6;AT 0,
19;am;" "
  500 PRINT  PAPER 0; INK in;AT 1
4,6;a$;AT 15,6;b$
  510 IF INKEY$<>"" THEN  LET f=1
: BEEP .01,-10
  520 LET a$=a$(2 TO )+a$(1): LET
 b$=b$(2 TO )+b$(1)
  530 PRINT  INK 5; PAPER 0;AT 20
,a;"(sp)A(sp)";AT 21,a;"(sp)B(sp
)"
  540 LET a=a+x
  550 IF a<7 THEN  LET x=1
  560 IF a>23 THEN  LET x=-1
  570 IF f=1 AND CODE (b$(a-5))>3
2 THEN  GO TO 600
  580 IF f=1 THEN  LET f=0: LET a
m=am-1
  585 IF am=0 THEN  GO TO 3000
  590 GO TO 400
  600 BEEP .01,20
  610 LET co=co+1
  620 LET b$(a-5)="(sp)"
  630 IF CODE (b$(a-6))>32 THEN
LET b$(a-6)="(sp)"
  640 IF CODE (b$(a-4))>32 THEN
LET b$(a-4)="(sp)"
  650 LET a$(a-6 TO a-4)="(3*sp)"
  660 LET sc=sc+va: PRINT  INK RN
D*6+1; PAPER 0;AT 12,13;sc;"(sp)
"
  670 IF co=5 THEN  LET go=go+10:
```



```
 GO TO 380
 675 IF am=0 THEN  GO TO 3000
 680 GO TO 580
1000 LET va=100: LET in=6: LET a
$="C(3*sp)C(3*sp)C(3*sp)C(3*sp)C
(3*sp)": LET b$="DE(2*sp)DE(2*sp
)DE(2*sp)DE(2*sp)DE(2*sp)": RETU
RN
1010 LET co=0: LET va=200: LET i
n=7: LET a$="FH(2*sp)FH(2*sp)FH(
2*sp)FH(2*sp)FH(2*sp)": LET b$="
GI(2*sp)GI(2*sp)GI(2*sp)GI(2*sp)
GI(2*sp)": RETURN
1020 LET co=0: LET va=300: LET i
n=4: LET a$="JL(2*sp)JL(2*sp)JL(
2*sp)JL(2*sp)JL(2*sp)": LET b$="
KM(2*sp)KM(2*sp)KM(2*sp)KM(2*sp)
KM(2*sp)": RETURN
1030 LET co=0: LET va=400: LET i
n=5: LET a$="NO(2*sp)NO(2*sp)NO(
2*sp)NO(2*sp)NO(2*sp)": LET b$="
PQ(2*sp)PQ(2*sp)PQ(2*sp)PQ(2*sp)
PQ(2*sp)": RETURN
1040 LET co=0: LET va=500: LET i
n=3: LET a$="RS(2*sp)RS(2*sp)RS(
2*sp)RS(2*sp)RS(2*sp)": LET b$="
TU(2*sp)TU(2*sp)TU(2*sp)TU(2*sp)
TU(2*sp)": RETURN
1050 LET co=0: LET va=600: LET i
n=7: LET a$="RS(2*sp)C(3*sp)FH(2
*sp)JL(2*sp)NO(2*sp)": LET b$="T
U(2*sp)DE(2*sp)GI(2*sp)KM(2*sp)P
Q(2*sp)": RETURN
1060 FOR f=0 TO 10: FOR g=7 TO 0
 STEP -1: POKE 59990,g: RANDOMIZ
E USR 60250: BEEP .001,f*2+20: N
EXT g: NEXT f
1065 RANDOMIZE USR 60050: BEEP .
01,20
1070 PRINT AT 20,a;"(2*sp)";AT 2
1,a;"(2*sp)": LET sc=sc+bon: LET
 tam=tam-5
1080 IF tam<30 THEN  LET sc=sc+1
0000: GO TO 3000
1090 GO TO 370
2000 BORDER 0: PAPER 0: INK 7: C
LS
2001 LET ink=RND*5+1
2005 FOR f=4 TO 5: PRINT  INK in
k;AT f,0;"(32*ig6)";AT f+13,0;"(
32*g7)": NEXT f
2010 PRINT  INK ink;AT 8,6;"(ig4
,ig7,g7,g2,ig4,g2,ig5,sp,ig4,g2,
sp,ig4,ig7,ig4,ig5,ig1,g5,g5,g3,
g5,g3,11*sp,ig4,ig7,g5,sp,ig4,sp
,ig5,sp,ig4,2*sp,ig4,ig7,ig4,ig5
,ig5,g7,g5,g5,g5,g2,11*sp,g2,g2,
g3,g2,g2,sp,g3,g2,g3,g2,sp,g2,g2
,g2,g2,g2,g1,g1,g3,g1,g3)"
2020 PRINT AT 12,0;"PRESS EITHER
 1. FOR INSTRUCTIONS(42*sp)OR 2.
TO PLAY"
2025 FOR f=0 TO 500
2028 RANDOMIZE USR 60200
2030 IF INKEY$="1" THEN  BEEP .0
1,10: GO TO 2060
2040 IF INKEY$="2" THEN  BEEP .0
1,10: GO TO 367
2050 NEXT f
2055 CLS : GO TO 3190
2060 CLS : INK 0
2070 PRINT "USE ANY KEY TO SHOOT
 AT THE"''"TARGETS."
2080 PRINT '"THE GAME WILL END W
HEN YOU HAVE"''"NO AMMUNITION LE
FT."
2090 PRINT '"IF YOU SHOOT ALL TH
E TARGETS"''"THEN YOU WILL GET S
OME BONUS"''"POINTS AND START AG
AIN WITH LESS"''"AMMUNITION."
2095 PRINT ''"PRESS ANY KEY.": R
ANDOMIZE USR 60100: BORDER 0
2096 PAUSE 0: CLS
2100 PRINT "WHILST YOU ARE PLAYI
NG THE GAME"''"YOUR GUN WILL MOV
E BACKWARDS"''"AND FORWARDS ACRO
SS THE"''"BOTTOM OF THE SCREEN J
UST TO"''"MAKE THINGS HARDER."
2110 PRINT '"REMEMBER TO ALLOW F
OR THE DELAY"''"BEFORE THE BULLE
T REACHES THE"''"TARGET."
2120 PRINT ''"PRESS ANY KEY."
2125 RANDOMIZE USR 60100: BORDER
 0
2130 PAUSE 0: CLS
2140 PRINT "C(3*sp)C(3*sp)C(3*sp
)C(3*sp)C(5*sp)100 POINTS"'"DE(2
*sp)DE(2*sp)DE(2*sp)DE(2*sp)DE(8
*sp)EACH"
2150 PRINT '"FH(2*sp)FH(2*sp)FH(
2*sp)FH(2*sp)FH(4*sp)200 POINTS"
'"GI(2*sp)GI(2*sp)GI(2*sp)GI(2*s
p)GI(8*sp)EACH"
2160 PRINT '"JL(2*sp)JL(2*sp)JL(
2*sp)JL(2*sp)JL(4*sp)300 POINTS"
'"KM(2*sp)KM(2*sp)KM(2*sp)KM(2*s
p)KM(8*sp)EACH"
2170 PRINT '"NO(2*sp)NO(2*sp)NO(
2*sp)NO(2*sp)NO(4*sp)400 POINTS"
'"PQ(2*sp)PQ(2*sp)PQ(2*sp)PQ(2*s
p)PQ(8*sp)EACH"
2180 PRINT '"RS(2*sp)RS(2*sp)RS(
2*sp)RS(2*sp)RS(4*sp)500 POINTS"
'"TU(2*sp)TU(2*sp)TU(2*sp)TU(2*s
p)TU(8*sp)EACH"
2190 PRINT '"C(3*sp)FH(2*sp)JL(2
*sp)NO(2*sp)RS(4*sp)600 POINTS"'
"DE(2*sp)GI(2*sp)KM(2*sp)PQ(2*sp
)TU(8*sp)EACH"
2200 PRINT ''"PRESS ANY KEY."
2205 RANDOMIZE USR 60100: BORDER
 0
2210 PAUSE 0: INK 7: CLS : GO TO
 2001
3000 FOR f=7 TO 0 STEP -1: POKE
59990,f: RANDOMIZE USR 60250: BE
EP .01,f*2: PAUSE 10: NEXT f: BO
RDER 0: BEEP .2,-20: CLS
3010 IF sc>h(5) THEN  GO TO 3050
3020 PRINT  FLASH 1;AT 8,8;"YOU
SCORED ";sc
3030 PRINT  INK 7;AT 16,9;"PRESS
 ANY KEY."
3040 PAUSE 0: GO TO 2000
3050 LET h$(5)="": PRINT "(5*sp)
PLEASE ENTER YOUR NAME"
3051 PRINT AT 10,10;"(---------
)": PRINT AT 15,8;"YOU SCORED ";
sc
3052 LET g=1
3054 PAUSE 0
3056 LET l$=INKEY$: BEEP .005,10
3058 IF l$=CHR$ 13 THEN  GO TO 3
080
3059 IF g>1 AND l$=CHR$ 12 THEN
 LET h$(5,g)="": PRINT CHR$ 8;"-
";CHR$ 8;: LET g=g-1: GO TO 3054
3060 LET h$(5,g)=l$
3062 PRINT AT 10,g+10;l$;
3064 LET g=g+1
3066 IF g<11 THEN  GO TO 3054
3080 CLS
3100 LET h(5)=sc
3110 LET zx=4
3120 FOR f=1 TO zx
3130 IF h(f)>=h(f+1) THEN  GO TO
 3160
3140 LET v=h(f): LET h(f)=h(f+1)
: LET h(f+1)=v
3150 LET v$=h$(f): LET h$(f)=h$(
f+1): LET h$(f+1)=v$
3160 NEXT f
3170 LET zx=zx-1
3180 IF zx>0 THEN  GO TO 3120
3190 PRINT AT 0,2; INK RND*6+1;"
(ig5,ig5,ig4,g2,sp,ig5,ig5,ig4,i
g5,ig5,sp,ig5,2*sp,ig4,ig5,ig4,g
2,sp,ig4,g2,ig4,ig5,ig4,ig4,ig5,
ig4,g2,4*sp,g7,g2,ig4,2*sp,ig4,i
g5,ig4,ig5,ig5,sp,ig5,2*sp,ig5,i
g5,ig4,2*sp,ig4,sp,ig4,ig5,ig5,i
g5,ig5,ig4,5*sp,g1,sp,g3,g2,sp,g
2,g2,g2,g2,g3,g2,g3,g2,sp,g3,g2,
g2,sp,sp,g2,sp,sp,g2,g2,g2,g2,g3
,g2)"
3200 FOR f=1 TO 5: PRINT  INK f+
2;AT (f*2)+3,0;f;" -------- ";h$
(f);AT (f*2)+3,21;" ---- ";h(f):
 NEXT f
3400 PRINT AT 18,5;"(4*sp)PRESS
ANY KEY.(4*sp)"
3405 FOR f=0 TO 1000
3410 IF INKEY$<>"" THEN  GO TO 3
65
3420 NEXT f: GO TO 2000
```

```
   1 REM E:RND?▀ TAN
   2 REM ****** METEORS ******
   3 REM ***(C) TIM MARTIN ***
   4 REM ***** 15-2-1985 *****
   7 GOTO 9005
   8 GOSUB 10
   9 GOTO 56
  10 POKE 16418,0
  20 FOR N=1 TO 23
  30 PRINT AT N,0;"[graphics]"
  40 NEXT N
  45 PRINT AT 0,0;"■ SCORE:00000
 HI SCORE:00000 ■";AT 0,30-LEN
H$;H$;AT 0,13-LEN S$;S$
  50 PRINT AT 21,0;"■
■"
  51 PRINT AT 22,0;" 000000000000
0000000000000000000 "
  52 PRINT AT 19,0;"[graphics]"
  53 PRINT AT 20,0;"[graphics]"
  54 PRINT AT 18,15;"A"
  55 RETURN
  56 LET A=17
  60 LET B=15
  70 LET Z=0
  75 LET C=15
  80 LET D=15
 100 LET X=1
 110 LET Y=INT (RND*27)+2
 120 PRINT AT X,Y;"■"
 130 LET Y=Y+(RND<.5 AND Y<30)-(
RND>.5 AND Y>1)
 135 LET X=X+1
 140 PRINT AT X,Y;
 150 LET P=USR 16514
 160 PRINT "■"
 170 IF P=0 THEN PRINT AT X,Y;"▀
"
 180 IF P=3 THEN PRINT AT X,Y;"■
"
 190 IF X=22 OR P=166 THEN GOTO
1000
 205 IF P<>128 AND P<>0 AND P<>3
 THEN PRINT AT X,Y;"■"
 209 PRINT AT C,D;"■"
 210 LET C=C+2*(INKEY$="6")-2*(I
NKEY$="7")
 215 IF C<1 THEN LET C=1
 217 IF C>17 THEN LET C=17
 220 LET D=D+2*(INKEY$="8")-2*(I
NKEY$="5")
 225 IF D>30 THEN LET D=30
 227 IF D<1 THEN LET D=1
 230 PRINT AT C,D;"X"
 240 IF INKEY$="0" THEN GOSUB 50
0
 292 IF P=128 OR P=189 THEN GOTO
 120
 295 GOTO 100
 500 LET E=C-A
 510 LET F=D-B
 520 LET M=ABS E
 530 IF ABS F>M THEN LET M=ABS F
```



PROTECT THE EARTH from the terrifying meteor storm in **Meteors** by Tim Martin of Reading, Berkshire. The game, for the 16K ZX-81, requires you to move your gunsight about the screen to accurately blast the meteors. If the meteors gouge a big enough crater in the earth, they will penetrate the crust and it's curtains for civilisation as we know it.

The short machine-code routine in line 1 is identical to that used in **Manhattan Caper** printed elsewhere in Program Printout. Please read the instructions for that program before attempting to enter **Meteors**, or the program will not work properly.

```
 540 FOR G=0 TO M-1
 550 PRINT AT A+G*E/M,B+G*F/M;
 560 LET P=USR 16514
 570 PRINT "+"
 580 IF P=CODE "O" THEN GOTO 700
 585 PRINT AT A+G*E/M,B+G*F/M;"■
"
 590 NEXT G
 595 LET Z=0
 600 RETURN
 700 PRINT AT X,Y;"■"
 710 LET S$=STR$ (VAL (S$)+10)
 720 LET Z=0
 730 PRINT AT 0,13-LEN S$;S$
 740 GOTO 100
1000 PRINT AT X,Y;"BOOM...."
1010 IF S$>H$ THEN LET H$=S$
1015 PRINT AT 0,30-LEN H$;H$
1020 FOR K=1 TO 100
1025 NEXT K
1030 GOTO 9010
8999 STOP
9000 SAVE "METEORS"
9005 LET H$="0"
9006 LET S$="0"
9010 GOSUB 10
9020 PRINT AT 17,16;"/   BASE";A
T 16,17;"YOUR MISSILE"
9030 PRINT AT 16,7;"O";AT 15,8;"
■";AT 14,9;"ROCK"
9040 PRINT AT 21,4;"▀";AT 20,5;
"■";AT 19,6;"CRATER"
9050 PRINT AT 21,19;"/";AT 20,20
;"■";AT 19,21;"REACTORS"
9060 PRINT AT 10,10;"X";AT 9,11;
"■";AT 8,12;"YOUR SIGHT"
9070 PRINT AT 12,12;"+";AT 11,13
;"■";AT 10,14;"YOUR MISSILE"
9080 PRINT AT 1,12;"METEORS"
9085 PRINT AT 2,11;"---------"
9090 PRINT AT 3,0;" YOU GUIDE YO
UR SIGHT WITH KEYS "5","6","7",A
ND "8","0" TO FIRE."
9100 PRINT AT 5,1;"     PRESS AN
Y KEY TO PLAY"
9110 IF INKEY$="" THEN GOTO 9110
9115 LET S$="0"
9120 GOTO 8
```

Vignere Cipher

TOP SECRET TOP SECRET TOP SECRET TOP SECRET TOP SECRET

Encode

```
   5 PRINT AT 1,1;"CAPITAL LTTER
S NO SPACES"
  10 INPUT "keyword "; LINE k$
  15 PRINT AT 3,1;k$
  20 INPUT "message "; LINE m$
  25 PRINT AT 5,1;m$
  30 LET s=LEN m$
  40 LET h$=k$
  50 LET h$=h$+k$
  55 IF LEN h$<s THEN  GO TO 50
  60 DIM a(s): DIM b(s)
  65 DIM c(s)
  70 FOR n=1 TO s
  75 LET a(n)=CODE m$(n)
  80 LET b(n)=CODE h$(n)
  90 LET c(n)=a(n)+b(n)
 100 NEXT n
 110 FOR n=1 TO s
 120 IF c(n)<=155 THEN  PRINT AT
 7,n;CHR$ (c(n)-65)
 130 IF c(n)>155 THEN  PRINT AT
7,n;CHR$ (c(n)-91)
 140 NEXT n
```

ALL THE BEST spies must have a code, and one of the traditional favourites used to be the **Vignere Cipher**. The Vignere uses a keyword and sliding alphabets, so that each letter is coded in a new code. That makes it difficult to crack.

T S Thomas of Kidwell, Dyfed, has written routines for any Spectrum to write and read Vignere cipher. You must enter the keyword first, and then the message. The message should be entered in blocks of 31 characters at a time or less, and you should only use capital letters, with no spaces between words.

Decode

```
   5 PRINT AT 1,1;"CAPITAL LETTE
RS NO SPACES"
  10 INPUT "keyword "; LINE k$
  15 PRINT AT 3,1;k$
  20 INPUT "message "; LINE m$
  25 PRINT AT 5,1;m$
  30 LET s=LEN m$
  40 LET h$=k$
  50 LET h$=h$+k$
  55 IF LEN h$<s THEN  GO TO 50
  60 DIM a(s): DIM b(s)
  65 DIM c(s)
  70 FOR n=1 TO s
  75 LET a(n)=CODE m$(n)
  80 LET b(n)=CODE h$(n)
  90 LET c(n)=a(n)-b(n)
 100 NEXT n
 110 FOR n=1 TO s
 120 IF c(n)<0 THEN  PRINT AT 7,
n;CHR$ (c(n)+91)
 130 IF c(n)>=0 THEN  PRINT AT 7
,n;CHR$ (c(n)+65)
 140 NEXT n
```



John Gilbert delivers the final blow

A key to a better adventure

THIS SERIES has introduced techniques you can use to build intelligent adventures.

We have looked at the task of setting up scenarios, giving characters life so that the computer can make decisions for those which it controls, and we have shown how the player and character can interact effectively.

The production of AI on the computer is more a case of hard slog by the machine than magic. We are, after all, talking about artificial intelligence and not 'conscious', or 'real', intelligence.

The series has dealt with a variety of techniques, all of which can be combined to create an AI adventure:

Scenario creation (February, *Sinclair User*) – the creation of a network of locations using routines to duplicate areas, such as sea or wilderness. All locations use a matrix system – for instance, a Basic two dimensional array. The name of the location is put into the array and used to access locations by line number.

Player and non-player character attributes (March) – the attributes of characteristics such as anger, love and hatred using a point system. A negative attribute (−) means the relative lack or opposite of a characteristic and a positive attribute (+) the existence of such a characteristic. Those are put into an attribute variable bank for each character.

Player/non-player interaction (April) – during the interaction of characters in, say, a fight scene the numeric characteristics change as the character develops.

One key movement and command (May) – a routine which scans the keyboard for a one key input which is either a direction or command, as opposed to sentence input.

English sentence parsing (June) – the computer searches through input commands for key words which describe the action.

In this, the last, article of the series we have produced a listing which puts into practice the techniques which we have covered. If you have missed part of the series you should find what you need in listing A.

For easy reference we have included

continued on page 90

Listing A

```
1 GO TO 10
2 DELETE mdv1_adprog
3 SAVE mdv1_adprog
4 STOP
10 REMark The Crysan Clock
20 REMark for 48K Spectrum or QL (mode 8)
30 CLS
40 PRINT "LEAVING MORRIS ON BOARD THE"
50 PRINT"LAUNCH KAGAN AND MARLA DIVE"
60 PRINT"INTO THE SEA IN SEARCH OF"
70 PRINT"THE STOLEN YACHT AND THE CRYSAN"
80 PRINT"CLOCK"
90 REMark ENTRY INTO THE WATER AND ENCOUNTER WITH THE TWO MONSTERS GHENGIS AND BOREEL. (SEE ISSUE MARCH 1985)
100 REMark THE ROUTINE GIVES MARLA AND KAGAN SOME CHARACTER ATTRIBUTES AND FROM THOSE WORKS OUT WHETHER THEY WILL FIGHT THE MONSTERS.
110 REMark IN YOUR OWN PROGRAM HOWEVER TE ATTRIBUTES WILL CONSTANTLY CHANGE AS THE CHARACTERS INTERACT WITH OTHER INHABITANTS AND SITUATIONS WITHIN THE ADVENTURE
120  REMark
130 LET C$="": LET P$="":LET N$=""
140 REMark SET UP ATTRIBUTES
150 DIM a(4,6): REMark attribute bank
160 RESTORE
170 FOR k = 1 TO 4
180 FOR M = 1 TO 6
190 READ a(k,M)
200 NEXT M
210 NEXT k
220 REMark data for attributes
230 DATA 5,4,3,7,6,6
240 DATA -2,-1,2,6,-5,-6
250 DATA -3,6,4,6,7,3
260 DATA 2,-3,4,6,4,6
270 REMark scenario set up
280 PAUSE 70
290 CLS
300 PRINT "The murky water clears as you"
310 PRINT "and Marla travel downward"
320 PRINT "towards the dark shadows which"
330 PRINT "mask the yacht which you have"
340 PRINT "picked up on your scanner."
350 REMark
360 REMark set up the monsters in scenario
370 IF a(3,2) OR a(3,3) OR a(3,5) < -1 THEN LET C$="Boreel"
380 LET f$="one creature guards"
390 GO TO 460
400 IF a(4,2) OR a(4,3) OR a(4,5) < -1 THEN LET C$="Ghengis"
410 LET f$="one creature guards":
420 GO TO 460
430 IF C$="" THEN PRINT "The yacht looms before you its"
440 PRINT "open door inviting you in."
450 GO TO 520
460 REMark
470 REMark print the monster/character set-up
480 PRINT "Soon the yacht looms menacingly"
490 PRINT "in the darkness."
500 PRINT f$; " the doorway."
510 GO TO 560
520 PRINT "You pass into the darkness beyond"
530 PRINT "the doorway."
540 STOP
550 REMark
560 REMark fight starts here
570 IF a(1,2) AND a(1,3) AND a(1,5) < -8 THEN LET P$="Marla": LET N$="kagan": GO TO 610
580 IF a(2,2) AND a(2,3) AND a(2,5) < -8 THEN LET P$="Kagan": LET N$=" Marla": GO TO 610
590 LET P$="Kagan and Marla"
600 STOP
610 PRINT "The thought of a fight chills ";N$;"'s"
620 PRINT "blood."
630 PRINT "He swims upward, back to the surface,"
640 PRINT "leaving ";P$;" to face the foe."
650 STOP
660 REMark
670 REMark fight routine
680 PAUSE 70
690 IF P$="Kagan and Marla" THEN LET q$="adventurers": LET z$="adventurers" : GO TO 710
700 LET P$="adventurer": LET z$="decides"
710 CLS
720 PRINT "The ";P$;" ";z$;" to go on."
730 REMark lead in to fight (see isssue April 1985)
740 LET N$=""
750 RESTORE 820
760 DIM c(4,6)
770 FOR k = 1 TO 4
780 FOR M = 1 TO 6
790 READ c(k,M)
800 NEXT M
810 NEXT k
820 DATA 5,3,7,9,4,3
830 DATA 9,2,-4,9,-3,4
840 DATA 9,7,-2,-7,7,-3
850 DATA 6,7,-3,-7,5,-3
860 IF c(1,5) < -9 THEN PRINT "Kagan can go on no longer": LET N$="Kagan": GO SUB 1020
870 IF c(2,5)< -9 THEN PRINT "Marla can go on no longer": LET N$="Marla": GO SUB 1020
880 LET g$=""
890 IF c(3,5) < -9 OR c(4,5) < -9 THEN GO SUB 1090
900 IF g$="stop" THEN STOP
910 IF c(1,2)< c(3,2) AND c(1,3)
```

continued from page 89

notes on the subroutines in figure one.

The issue of *Sinclair User* in which further information about specific routines can be found has been included within the program listing, which also contains information about what is happening in subroutines within REM statements.

As stated at the beginning of the series, the power of the AI techniques cannot be appreciated in Basic. The reason for writing them in such a slow and easy language is that they will be available to a wider audience than if they were written in Pascal or machine code. Try converting them into your particular pet language and you can start getting near to the excellence of **The Hobbit** or **Sherlock**.

All it takes is a little bit of imagination and work. Who knows what sort of intelligent adventure worlds you can create?

Figure 1. Subroutines

10-110	storyline update
120-350	set up initial control variables
360-460	set up the monster variables for Boreel and Ghengis
470-540	set up monsters in scenario
560-1120	fight scenario between heroes and monsters. This depends upon which characters are present and the values within the attribute bank
1140-1300	set up the objects available in scenario and allow characters to pick them up
1320-1670	one-key movement routine
1690-2330	'english' sentence parser. Will decipher SAY TO and TAKE but can be easily extended

Listing A continued

```
> c(3,3) AND c(1,5) < c(3,5) AND
 c(1,6) < c(3,6) THEN LET c(1,2)
=c(1,2)+1: LET c(1,5)=c(1,5)-1
920 GO TO 1020
930 LET c(3,2)=c(3,2)+1
940 LET c(1,5)=c(1,5)-1
950 IF c(2,2) < c(4,2) AND c(2,3
) > c(4,3) AND c(2,5) < c(4,5) A
ND c(2,6) < c(3,6) THEN LET c(2,
2)=c(2,2)+1
960 LET c(2,5)=c(2,5)-1
970 LET c(2,6)=c(2,6)-1
980 GO TO 1020
990 LET c(4,2)=c(4,2)+1: LET c(4
,5)=c(4,5)-1
1000 LET c(4,6)=c(4,6)-1
1010 GO TO 280
1020 REMark monsters kill charac
ters
1030 IF c(3,5) > 4 AND c(3,6) >5
 AND c(3,6) > 4 THEN PRINT "Bore
el finishes off "; N$
1040 LET N$=N$+"X"
1050 IF c(4,3) > 4 AND c(4,4) >
5 AND c(4,6) > 4 THEN PRINT "Ghe
ngis kills "; N$ : LET N$=N$+"X"
1060 IF N$="KaganX" THEN LET c(2
,1)=c(2,1)-2: LET c(2,2)=c(2,2)+
2
1070 IF N$="MarlaX"  THEN LET c(
1,1)=c(1,1)-2: LET c(1,2)=c(1,2)
+2
1080 RETurn
1090 REMark monsters are killed
1100 IF c(3,5) < -9 THEN PRINT "
Boreel is dead"
1110 IF c(4,5) < -9 THEN PRINT "
Ghengis is dead": LET g$="stop"
1120 RETurn
1130 REMark
1140 REMark pick up object subro
utine.  Enter the object, weapon
 or monster of your choice and t
he computer will recognise it fo
r what it is
1150 LET B$="*wswo*oorb*orope*mG
hengiis*mBoreel": REMark w=weapo
n, o=object, m=monster
1160 INPUT a$
1170 LET C$=a$(1 TO 3)
1180 LET k=1
1190 IF B$(k)="*" THEN GO TO 123
0
1200 IF k=LEN(B$) THEN PRINT "No
t found": GO TO 1160
1210 LET k=k+1
1220 GO TO 1190
1230 LET M=k+2
1240 LET c=M+2
1250 IF C$=B$(M TO c)THEN GO TO
120
1260 GO TO 1210
1270 IF B$(k+1)="w" THEN PRINT a
$;":";" You have found a weapon.
"
1280 IF B$(k+1)="o" THEN PRINT a
$;":";" You have found an object
."
1290 IF B$(k+1)="m" THEN PRINT a
$;":";" A monster stands before
you."
1300 GO TO 1160
1310 REMark
1320 REMark this routine impleme
nts a one character input routin
e for (n)orth, (s)outh, (e)ast,
(w)est, (u)p and (d)own (See iss
ue May 1985)
1330 LET o$="sword": LET i$=""
1340 PAUSE 0: LET a$=INKEY$: IF
a$="" THEN GO TO 1340
1350 IF a$="g" THEN GO TO 1390
1360 IF a$="t" THEN GO TO 1440
1370 PRINT#0; "I can't do that"
1380 GO TO 1340
1390 LET n=0: LET d=0: LET s=400
0: LET u=4050: LET w=5000: LET e
=5050
1400 GO SUB 1520
1410 IF b=0 THEN PRINT "You can'
t move in that direction"
1420 GO TO 1340
1430 GO TO b
1440 INPUT "Take what ";a$
1450 IF o$="" THEN PRINT "There
are no objects here to pick up."
1460 GO TO 1340
1470 IF a$ <> o$ THEN PRINT "Tha
t's not here."
1480 GO TO 1340
1490 PRINT "Taking the ";o$
1500 LET i$=i$+"*"+o$
1510 GO TO 1340
1520 INPUT "Where to ";B$: LET B
$=B$(1)
1530 IF B$="n" THEN LET b=n
1540 IF B$="s" THEN LET b=s
1550 IF B$="e" THEN LET b=e
1560 IF B$="w" THEN LET b=w
1570 IF B$="u" THEN LET b=u
1580 IF B$="d" THEN LET b=d
1590 RETurn
1600 CLS: PRINT "You are in the
throne room": PRINT "A huge thro
ne, upon which a vast": PRINT "c
reature rests its glistening lim
bs,": PRINT "dominates the hall.
"
1610 GO TO 1340
1620 CLS: PRINT "You push the Ke
lrosians back and": PRINT "race
up the damp stairs only to be":
PRINT "confronted by an abyss. I
t looks as": PRINT "if you've ha
d your fish and chips."
1630 GO TO 1340
1640 CLS: PRINT "You race toward
s the exit hotly": PRINT "pursue
d."
1650 GO TO 1340
1660 CLS: PRINT "You race to the
 door but are": PRINT "are tripp
ed.  You fall heavily."
1670 GO TO 1340
1680 REMark
1690 REMark a routine to deciphe
r English sentences is necessary
 in an AI adventure so the routi
ne follows.  It is documented so
 you can see what is going on an
d how to change it for you oown
needs.
1700 REMark At the moment it sup
ports the SAY TO character and G
O types of instruction.
2000 CLS
2010 REMark ENTER INSTRUCTION
2020 PAUSE 70: CLS: INPUT a$
2030 REMark START OF MAIN LOOP T
O SEE WHICH TYPE OF COMMAND IS I
N OPERATION
2040 FOR k = 1 TO LEN(a$)
2050 REMark G=GO AND S=SAY TO
2060 IF a$(k)="G" OR a$(k)="S" T
HEN GO TO 2100
2070 REMark GO TO 200 IF MAIN CO
MMAND TYPENOT FOUND YET
2080 GO TO 2120
2090 REMark FURTHER CHECK ON INS
TRUCTION TYPE
2100 IF a$(k TO k+1)="GO" THEN G
O TO 2150
2110 IF a$(k TO k+5)="SAY TO" TH
EN GO TO 2180
2120 NEXT k
2130 STOP
2140 REMark MOVEMENT ROUTINE SHO
ULD BE SITUATED HERE.
2150 PRINT "A DIRECTION"
2160 REMark GO BACK FOR MORE INP
UT
2170 GO TO 2020
2180 PRINT a$
2190 REMark CHECK TO SEE IF PLAY
ER CALLED CORRECT CHARACTER IE.
AN ALIEN.
2200 IF a$(8 TO 11)="ALIE" THEN
GO TO 2240
2210 REMark NOT ASKED FOR CORREC
T CHARACTER
2220 PRINT"NO CHARACTER OF THAT
NAME HERE":PAUSE 0: GO TO 2000
2230 REMark START OF SCAN TO FIN
D APOSTROPHE WHICH REPRESENTS QU
OTE MARK.
2240 LET M=1
2250 IF a$(M)="'" THEN GO TO 231
0
2260 REMark IF NOT FOUND ERROR I
N INSTRUCTION.
2270 IF M=LEN (a$) THEN PRINT"I
DON'T UNDERSTAND": GO TO 2000
2280 REMark CONTINUE SCAN
2290 LET M=M+1: GO TO 2250
2300 REMark TAKE EVERYTHING BETW
EEN QUOTE MARKS AND PUT IN NEW V
ARIABLE TO BE TREATED AS SEPARAT
E INSTRUCTION STRING.
2310 LET B$=a$(M+1 TO LEN (a$)-1
)
2320 REMark MONSTER REPLIES BUT
YOU CAN INSERT MORE IFS FOR REPL
IES OR USE THE STRING SEARCH TEC
HNIQUE AGAIN.
2330 IF B$="WHERE IS THE CLOCK"
THEN PRINT "THE ALIEN SAYS: 'IT
IS BEHIND MY THRONE, BUT THAT IS
 OF LITTLE MATTER TO YOU.'"
```

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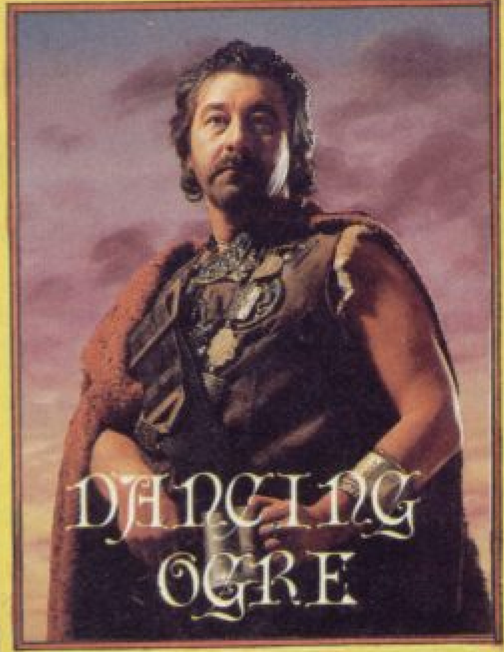
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Greetings one and all from balmy Samarrak, whose market is renowned for its magical wares and weaponry. The woes I recounted to you in my last missive have been soothed by a letter from the Lady Marion.

"Be ye not desolate," says she. "Know that scrolls sent to he known as the Grand Elf were scribed in the distant past, long ere you were my favour." My old heart quickens at this news. Mayhap you will encounter the lady within the webs of Micronet, as she dispenses Scrolls of Wisdom.

This market then — as Zul, Zel and I strolled through the booths we met many travelling merchants who had passed by the Ogre over the years.

From Zignash, a reformed orc and member of the Guild of Ectoplasmists, I purchased the bottled spirit of Firedemon. I am confident the imp will prove useful. From Majari, a shifty southern crook with an eyepatch, I acquired two ounces of Black Lotus — enough he said to render an entire army amnesiac and unconscious.

Besides these I bought loaded dice — a man must make a living — salves and balms, a new ring mail hauberk, a bronze cap topped with a silver boar and a spiked mace. This has the power to return to the bearer when thrown or dropped. A few tests proved the efficacy of this wondrous club, though I was forced to recompense a group of eastern nomads for the loss of two camels.

Many bemused adventurers thronged the wine stalls. Sir Lee the Knightley, Pip of Hipwell and the Lady Carol de Whitham have long tried to prove the innocence of the drugged Major, one of **Sherlock***'s suspects.*

Once you have revealed yourselves to this old soldier in his opium den, there are but two short minutes in which to save him from Lestrade's bullets. Be swift — tell the Inspector simply that the Major has visited the den. The key is 'Visit'. Opium he may eat, lead he need not.

Another task for the detective is to solve certain codes found on sundry scraps of paper. Hardiman Harding of Brighton and Jugman Johnson of Sunderland pressed me for the answer. This is not so simple — the torn note and the ripped note are both parts of the same message and have the same code.

Consult your great tome — such as the venerable Britannica — for articles on cryptology. In them you may find frequency tables which show the letters used most often in the English tongue. Count the letters in the message to find the most frequent — this should be 'E'. One of the three-letter words is 'THE'. From here you can begin to build up the message, by guesses and sheer hard work.

Lastly the singed note; care is needed as it is the reply to the others and, curses, is writ backwards! Reverse it and begin your decoding in the same way.

Master Hipwell claims full success in **Mountains of Ket, Temple of Vran, Urban Upstart** *and* **Snowball.** *Write to him — courier prepaid — at 3 Spring Lane, Wymondham, Melton Mowbray, Leicestershire LE14 2AY.*

Clive the Parson of St. Columb seeks the **Eye of Bain** *but cannot pass the dreadful creature in the well. Once he has his ruby he should read the inscription thereon. This will tell him what can harm the beast — one of the elements.*

Gordo purchases some magical wares and drops clues in the wine stalls

This element is contained within the gem itself and he must descend into the depths and simply SAY the name of the element. In the same quest Mantle of Sheffield cannot get rid of the chain: find a rock and strike it off. Thus 'tis done.

Huntsman Hunt of Barrow and the fair Alison of Wirral sat in argument over the shapechanging at **The Witches Cauldron.** *One wished to become an ape. Take the eyes of a sheep, a diamond which makes music, a snail which lives with mice, and Moonshine — the liquid kind and not Our Lady's beams.*

Climb a bench, crush the snail-shell in a pestle and then stir this horrid brew in the cauldron. Drink and ye shall become an ape.

Fair Alison could not change at all. For your first turn, turn about three times and say pussycat backwards — then you may begin the quest. Those who become apes may climb a cupboard and find a key. Southerly doors will open then.

Toiler Thompson of 57 Derwent Drive, Milton Manor, Tewkesbury, Gloucestershire knows many secrets of **Tir Na Nog** *but cannot reach Dhub Sgorr or Snathad. Share help with him if you will as he knows Middle Earth well.*

Sharing a cup with the Lady Sheila of Cambridge she confided to me a number of troubles. First the ogre beyond the pool in the **Mountain of Ket.** *Try as she might she could not get him to dice with her. I suggested that she might need to read the Goblin Gazette before so doing as this ogre is publicity conscious.*

To hell had she been too, even to the **Inferno.** *She could not get round three-headed Cerberus. If she digs close to him she may find something to throw.*

Master Adventurer Walters of Knotty Green came by with hints in the quest of **Dragon Torc.** *On the first level search for a bow and trade this for a sickle with an elf. Cutting herbs with this will gain an ENERGISE spell.*

Also, under a slab there lies a jewel. Trade it likewise for a message which, taken to yet another slab, will reveal the second level: the Lost Vaults — do you not shudder? Those who wish to escape this level must find the letters EXIT — subtlety here! — and arrange them on top of the E to reveal yet another layer.

Dolsig of I know not where and Stanley of Bromsgrove wandered by. I heard them groaning over **Valkyrie 17** *and leapt to their aid. Having killed the evil Reichsmuller, Dolsig had no clue about his next steps. A taxi he must find. To take him where? Ah, he should have looked through a seafront telescope — forward and back. A destination should become visible once that is done.*

Stanley could find no cash to pay his hotel bill — I know the type. Pawn some valuables in the town but remember you cannot go by cablecar. Skis are the thing. See amid the winter's snow . . .

So farewell again my friends. To Urtuun I must now go, ever southward and ever onward. There I hope to hear of the Ogre's fate and my hope for comfort in my age. 'Til next moon. Ride and prosper.

Greatbelly

Gordo Greatbelly, Landlord

If you have a tale to tell, or are in need of a helping hand, write to the Landlord of the Dancing Ogre c/o Sinclair User, Priory Court, 30-32 Farringdon Lane, London EC1R 5BH.

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```
10 FOR n=1 TO 10: PRINT n: NEXT n
```

as:

```
10 FOR n=1 TO 10
      PRINT n
    NEXT n
```

- KEYWORDS can all be entered by typing them in full, or by the "single entry" method, or both in the same line; e.g. the line: 10print"hello":if x=1 THEN goto 100 will be recognised and listed normally.
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[ ] BETA BASIC 1.8, PAYMENT OF £8.95 (£9.50) IS ENCLOSED.
[ ] MORE INFORMATION ON ________, I HAVE/DO NOT HAVE RELEASE 1.8 ALREADY. A STAMPED ADDRESSED ENVELOPE IS ENCLOSED.

BETA SOFT

92 OXFORD RD,
MOSELEY
BIRMINGHAM
B13 9SQ

Richard Price sets out on the road to Rivendull while Tolkien turns in his grave



Nasty hobbits

NOT LONG AGO, after a long day at the keyboard, I settled down in front of the TV for a few hours of mindstretching intellectual activity – namely *Hawk the Slayer*, a film which would make *Mary Poppins* seem like high art.

At the beginning was a short voiceover which summed up the plots of about 75 percent of all adventure programs: "This is a story of heroic deeds and the bitter struggle for the triumph of good over evil and of a wonderous sword wielded by a mighty hero when the legions of darkness stalked the land."

All but one of this month's software fall into this category. Games designers seem to think that this sort of plot is all that most players need. I doubt it and once again make a plea for real storylines and humour. Grumble, grumble . . .

Never mind though, Delta 4 Software has taken the archetype of all those solemn hero tales and turned out a classic parody.

Bored of the Rings

Bored of the Rings is a direct and cheerful spoof of Tolkien's trilogy, only the names and aims have been changed to protect the innocent – and to avoid hassles with the copyright.

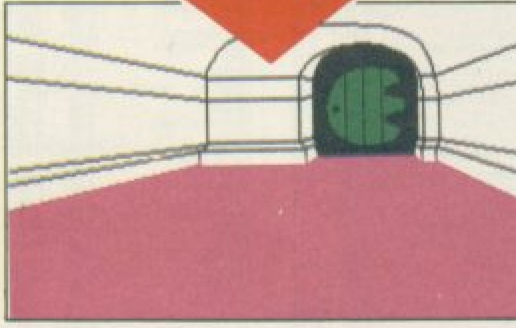
The game is in three parts and has been written with the **Quill**. There are also graphic scenes produced by Gilsoft's new **Illustrator** package. Delta 4 has plumbed in a fairly pleasing medieval-style typeface and the general presentation is clear and easy on the eye. You get from one part to the next by way of a password given at the end of each section.



First, the plot. Naturally it is very similar to the original but the characters and detail are, ahem, somewhat different. Fordo the Boggit lives in the Shire with his uncle Bimbo. On the principle of W C Fields' dictum 'never give a sucker an even break' he gets landed with the job of returning the Great Ring to Mount Gloom in the Land of Dormor.

So begins the great quest. Fordo and his cowardly chums, Spam, Pimply and Murky set off for Whee through the forest. On their way they encounter Tim Bumbadil, the ageing acid-crazed hippy and his flower-child girlfriend Hashberry.

From Whee they head towards Rivendull where the full company teams up. There's Legoland the Elf,

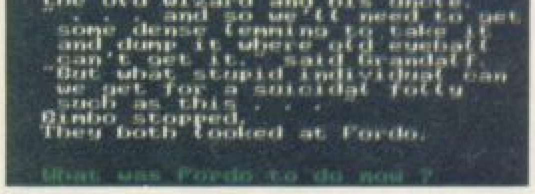


Giblet the Dwarf and Aragont, who continually recites his ancestors' names at any conceivable opportunity.

Part one ends at the gates of the Morona Cave Tourist Complex and is fairly simple to solve, acting as more of a scene setter than anything. The second and third sections are tougher but retain the same irreverence towards the great epic.

The humour can be fairly schoolboyish at times and there are a couple of occasions when it is both distasteful and unnecessarily unpleasant. On the whole though the game is great fun and well-produced too.

For your £5.95 you will get two cassettes and a daft little booklet with a map of the trek. There's also a microdrive version at £8.95. Fergus McNeill, the author, has told me that the game has been accepted for distribution so you should have little trouble getting it. If not, write to Delta 4, The Shielding, New Road, Swanmore, Hampshire SO3 9PE.



Return of the Joystick

This month is not the Delta 4 Benefit Month and it is pure coincidence that another of its games has turned up in my in-tray.

Return of the Joystick is the sequel to **The Quest for the Holy Joystick**. I have never seen the first game but I presume the aim is the same. Like Bored this adventure is written with the **Quill** and **Illustrator** and features the same quirky sense of humour.

The game begins outside Alexandra Palace where one of the many ZX Microfairs is about to open. You are a



Illustration: Graham Ward

typical computer punter on the look-out for cheap games and equipment. Little do you know that your simple needs will lead you into the search for the Holy Joystick which is secreted somewhere within the several reality layers of the game.

From the bus stop at Ally Pally you can wander around London and its suburbs. Various well known computing firms can be visited and, in the offices of a nameless publishing company, you will encounter T*ny Br*dge and other agents of darkness.

Large numbers of computer games



can also be found there – such as Chublock and Sabre Wilf – and you can enter those games to find vital objects.

There's an element of satire and large numbers of gratuitous tricks – I stepped off the path at Ally Pally only to be devoured by a Bengal tiger and told: 'Gosh, that was unfair wasn't it? Another feeble attempt?'

Reality shifts between the ordinary world and the strange environments of the games. Occasionally you will step into a new location only to find yourself in the USSR or the mystic territory of Delta Tower.

Every entry counts as a minute in the game world and some things will only happen at particular times – if you're in the wrong place that's tough.

Starting time is 9am and you must finish by 10pm. The game gives very little help and it is easy to waste time.

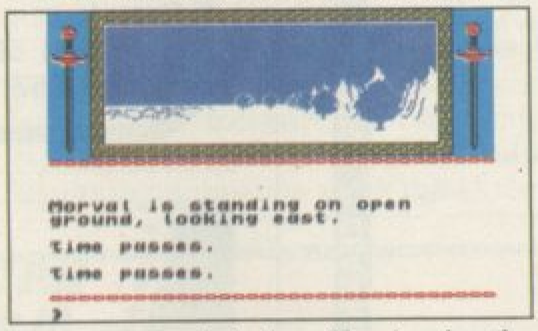
Return of the Joystick is not as compulsive as Bored but it is equally well put together and does have the virtue of not being an orc-basher game. Some of the humour relies upon in-jokes and you may find that some of the characters are unknown to you – the world of computing companies and magazines may seem big to those in it but to outsiders it may not have the same appeal.

Runestone

There is another double feature this month – this time from Games Workshop.

Runestone is, as far as I know, the only game to date which combines the kind of graphic countryside pioneered in **Lords of Midnight** with a regular text adventure interpreter.

The legions of darkness in this game



are commanded by Kordomir the Dark One. To overcome this evil you must find the Runestone but you will have to search the length and breadth of the Northern Wastes to get help from the Mages of Belorn and the secrets of Saromunder. Orcs are everywhere but there are also allies along the way.

You control three characters in turn, each can be sent on their own journeys among the mountains, lakes and meadowlands of Belorn. There are towers, huts, pavilions and caves which can be entered and dragonships for the lake crossings. Other characters live their own lives while you dither over where to go next.

You needn't go all out to crush the nasty Kordomir if you don't feel like it – there are the treasures of Belorn to be found, the bitter joy of battle against the orcs or else you can simply wander around and take in the sights – my favourite, I have to confess. With about 2000 locations and four views to each that's quite a lot of looking.

The graphics are quite like those in Midnight and you move in the direction which takes your fancy. The features advance and recede as you move. The location picture takes up the top half of the screen and the text buffer scrolls up beneath it.

Commands can be strung together with commas and many can be abbreviated, which means you can move through the country very fast if necessary. Up to 63 characters can be entered at any one time so you can type your instructions in with some fluency. The text interpreter only seems to understand the first three letters of each word – this can result in confusion at times.

The three heroes are Morval the Warrior, Eliador the Elf and Greymarel the Wizard. Other folk are generally individuals and I found no armies in the part of Belnor I explored. The game is more traditional adventure than strategy – no bad thing in my book.

You cannot take control of the subsidiary characters and I found them tough to converse with – that is no criticism as interactive characters are a bonus, even in text-only games.

Runestone is an intriguing combination of ideas and formats. The orcs are particularly unpleasant and the combat routines fast and furious. The heroes each have their own cross to bear and their own skills. And watch out for Skrimnal who will rip you off something rotten!

Key of Hope

The second Games Workshop release is **Key of Hope**, the successor to **Tower of Despair** and a two part adventure with some graphics.

Tower featured a cover picture of a strapping weight lifter. **Key of Hope** sports a dramatic, nay pneumatic, warrior-maiden surrounded by fierce beasts and icy pinnacles . . . phew.

This program too is written on the **Quill** and has a difficult gothic typeface. The plot continues the tale of Aelandor in Tower.

Castle Argent has been reduced to ruin and the ever-evil Malnor threatens to take over the world. Find the pieces of the key and then destroy Malnor – thus saving the world for the White Goddess of Truth.

All this is better than going to the office though a bit more strenuous. There are 400 locations and an assortment of magical artifacts and horrors.

continued on page 99

continued from page 97

The graphics on the review copy were very simple although a call to the Workshop gave me reassurance that these were not the final versions. Neither was the Examine function very productive, except with specific objects, and it could have more variation in its response.

If you enjoyed **Tower of Despair** then you will no doubt relish the sequel.

Ashkeron

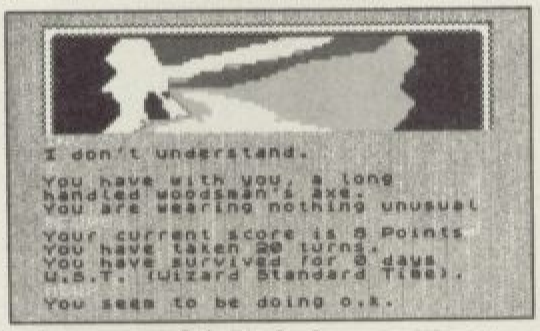
Still in the worlds of wizardry we come finally to **Ashkeron**.

The wizard has purloined poor Princess Zeraphina's dowry of five great treasures. Without them her marriage will be ill-starred and will bring ruin to the bucolic paradise of Ashkeron. You are Stephen the Blacksmith and have vowed to enter the sorcerer's lair to recover the sparklers.

You might be forgiven for thinking this was an **Avalon** style graphics game – 'walk-thru graphics' on the cover could suggest this. In fact the game is a text adventure with graphics which blend into the next location picture when you move. That happens with a machine-gun roaring which adds nothing to the game.

Text input is standard verb-noun and you can choose between a game where the objects always begin in the same place or a randomised version. The game is in real time so events will progress whether you do or not.

The castle is quite large and com-



plex though often you can do nothing with the rooms – in the clock tower you cannot examine either the tower or the clock. Other characters can be spoken to and the castle staff can occasionally be helpful. The Examine function can be odd – I picked up a candle, tried to examine it and was told it was not there!

The trouble with games which expect you to find treasure is that there is no other incentive to carry on, especially if careful exploration only results in information about things the programmers consider important.

This is not my type of game. It is not enormous – only 125 locations – and it doesn't have the detail which provides a compelling atmosphere. Nevertheless, it is well-made and attractively presented. The prospect of a £25 prize each month for the highest score may induce you into **Ashkeron**. Not me – I'm going to get back to Fag End and Boggiton.

Bored of the Rings
Publisher Delta 4 **Memory** 48K
Price £5.95 (£8.95 microdrive)
★★★★★

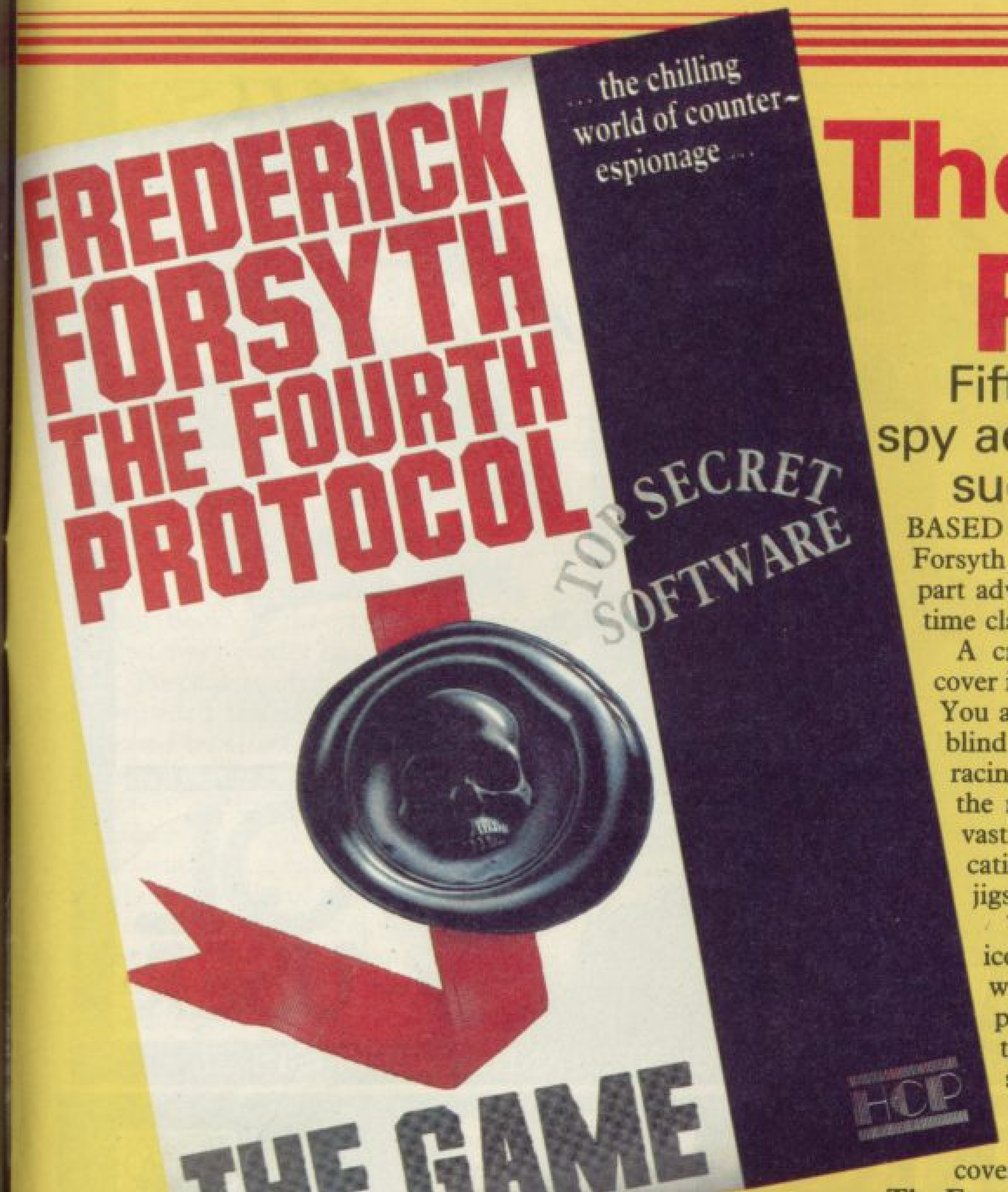
Return of the Joystick
Publisher Delta 4 **Memory** 48K
Price £4.95 (£6.95 microdrive)
★★★

Runestone
Publisher Games Workshop
Memory 48K **Price** £7.95
(includes m/d conversion)
★★★★

Key of Hope
Publisher Games Workshop
Memory 48K **Price** £7.95
★★★★

Ashkeron
Publisher Mirrorsoft **Memory** 48K
Price £5.95
★★★





The Fourth Protocol

Fifty copies of the classic spy adventure to be won by successful code breakers

BASED on the best-selling spy novel by Frederick Forsyth, **The Fourth Protocol** is a complex three-part adventure, destined to become one of the all-time classic games for the Spectrum.

A crack Soviet agent has been placed under cover in Britain to undermine the NATO alliance. You are MI5 investigator John Preston, working blind to uncover a plot of chilling devastation, racing against an unknown deadline. You have the resources of surveillance networks and the vast databanks of MI5's central communications computer to piece together the deadly jigsaw.

The game, from Century-Hutchinson, is icon-driven, making use of multi-layered windows depicting memos, reports, voice-prints and files, as well as detailed maps. In the final, graphic, sequence you have seconds only in which to defuse the weapon, and to do so successfully lightning reflexes must be combined with information discovered earlier in the game.

The Fourth Protocol is due to be released on June 20 and will be available from all leading high street stores, priced £12.95. Boots is offering a special package of the game together with the book, for £14.95.

Century-Hutchinson Computer Publishing is offering 10 first prizes of the book/game package, and 40 second prizes of the game alone, to the winners of our competition.

Your agent has finally penetrated the subversive organisation which plans to explode a nuclear bomb at an air force base. Unfortunately the bad guys are on to her, and she has been forced to improvise a simple code to tell you what will happen and how to stop it.

You will have to crack the code to discover the truth. When you have done so, write the combination number which will disarm the bomb on a postcard and send it to The Fourth Protocol Competition, at *Sinclair User*, Priory Court, 30-32 Farringdon Lane, London EC1R 3AU by Friday, July 19.

The first 10 correct entries pulled from the post bag after that date will win the book/game package, and the next 40 will win the game.

Employees of EMAP and Century-Hutchinson, their friends and associates, are not allowed to enter.

PAU JKKJOBPBJI ACO EMJQYAP RJMVCMT PAU TCPU JR PAU
USUIP PAU KGCI BO PJ TUPJICPU PAU EJHE CP HBTIBYAP
PJIBYAP EX PAU PBHU XJQ YUP PABO HUOOCYU PAU EJHE
VBGG CGMUCTX EU BI KGCNU CP PAU ECOU TJ IJP
CPPUHKP PJ MUHJSU BP QIPBG BP ACO EUUI TBOCMHUT PAU
NJHEBICPBJI BO RJQM OUSUI ZUMJ PAMUU YJJT GQNF

Andrew Hewson unravels code hidden in the memory map



PEEKing into a Basic RAM

MOST READERS will know that the Spectrum and Spectrum Plus are virtually identical internally. Unfortunately, Sinclair has completely rewritten the book supplied with the machine. Previously *ZX Spectrum Basic Programming* described the machine in some detail. I have always been careful to refer to this book in the certain knowledge that every reader has a copy.

Purchasers of the new machine are provided instead with the *ZX Spectrum Plus User Guide*. It is undoubtedly a prettier book – lots of colour screen shots and other nice touches. However, it contains much less hard information than its predecessor. There is no list of system variables and their functions. Nor is there a description of variable structures. Hence readers will have to forgive me if I labour points which could more conveniently be covered by reference to the original manual.

The topic this month is based on a letter from Simon Halford of Rotherham. He writes: **I read in Helpline, March 1985, about PEEK and I used it to look at my Basic programs, but I can't understand the codes. Can you explain?**

The method used by the Spectrum to store Basic programs is complicated so I shall approach the explanation in three stages. First we need to work out where to look in memory to find the Basic program. Then we need to display a part of a program on the screen in its 'raw' form – that is, in the form of the underlying numeric codes. Finally we must work out the relationship between the codes and the Basic program as it is normally understood – as it is displayed by the LIST command.

Spectrum programs are stored in the area of memory designated by the PROG and VARS system variables. Those variables are stored in memory at addresses 23635 and 23636 (PROG) and addresses 23627 and 23628 (VARS). The values of those variables can be inspected using the PEEK command.

```
10 REM Peek program
20 FOR I=23755 TO 23772
30 PRINT I,PEEK I
40 NEXT I
```

Table 1. A Spectrum program to PRINT the contents of the first 18 locations in the Basic program area.

Thus, to identify the memory location which holds the first byte of a Basic program, enter the line

PRINT PEEK 23635+256★PEEK 23636

The value PRINTed will be 23755 except when an Interface 1 is attached to the machine.

To obtain the address of the last memory location used by a Basic program enter the line

PRINT PEEK 23627+256★PEEK 24628−1

The value PRINTed will of course vary, depending on the length of the current Basic program.

Having worked out the correct area of memory the next step is to enter a short Basic program to look at the contents of that area and PRINT the codes stored there. The program in table one will suffice for this purpose. It PRINTs the contents of the first 18 bytes of the Basic program area. I have chosen to display 18 bytes for two reasons: 1 – the resulting 18 line display fits comfortably on the Spectrum screen; and 2 – the first line of the program, line 10, happens to occupy 18 bytes in the Basic program area. Thus the program displays the memory contents corresponding to the complete first program line.

Table two shows the display produced by the Basic program. The first two bytes are 0 and 10 respectively and they tell the computer that the number of this program line is 10 because

0★256+10=10

To prove that try POKEing other numbers into either of those locations and then LISTing the program. For example

POKE 23755,14

will change the line number to 3594 because

14★256+10=3594

When you have tried this a couple of times with different numbers it is best to POKE the original numbers 0 to 10 back into those locations otherwise

continued on page 106

continued from page 105

you may get into a muddle.

It is interesting that the order in which those two numbers are stored is the reverse of the usual Z80 convention. In this case the most significant byte – ie the byte which determines whether the result is going to be large or small – preceeds the least significant byte – ie the byte which adds a little bit at the end of the calculation.

23755	0
23756	10
23757	14
23758	0
23759	234
23760	80
23761	101
23762	101
23763	107
23764	32
23765	112
23766	114
23767	111
23768	103
23769	114
23770	97
23771	109
23772	13

Table 2. The form in which the program line
10 REM Peek program
is held in the program area.

I have always assumed that this quirk is a hangover from Sinclair's original home computer, the ZX80. As the system clearly works the manufacturers have not bothered to change it during the development of first the ZX-81 and then the ZX Spectrum.

The next two memory locations, 23757 and 23758, together record the amount of space occupied by the remainder of the line. In this case the whole of the line occupies 18 bytes but two bytes are used to hold the line number and two more bytes are used to hold this length marker, so the length marker contains 14 and 0. The calculation is

Length of remainder of line = 14+256★0=14

Note that this time the numbers are stored in the conventional order with the least significant byte first.

The next byte. 23759, is the meaty bit of the line because it contains the code of the Basic keyword and in this case takes the value 234. Spectrum owners can turn to page 188, appendix A of *ZX Spectrum Basic Programming* to confirm that this is the code for the keyword "REM". Spectrum Plus owners will find the same information coveyed in the table headed 'ZX Spectrum Plus character set' on page 51 of their user guide.

The remaining 13 bytes of the line can all be decoded using Appendix A or the table on page 51. The first 12 will be found to represent the letters and spaces in the comment 'Peek program'. The final byte is described as the ENTER character and it is used to denote the end of a line.

The program in table one can of course be adapted to look at any program line. Try substituting the following for line 10

10 LET a=1443

The display is shown in table three.

Once again the line number 10 is stored in locations 23755 and 23756. The line occupies the same amount of space in memory as its predecessor, that is 18 bytes, and so the remaining length marker is once again set to 14. The fifth location at address 23759 this time contains 241 and reference to appendix A, or the table on page 51 will show that this is the code for the keyword 'LET'. Inspection of the next six bytes will show that they represent the six characters a, =, 1, 4, 4 and 3. None of that is surprising when comparison is made with the line analysed previously.

However, it is surprising that the next location, 23766, does not contain the ENTER character – code 13 – indicating that the end of the line has been reached. Instead it contains the value 14 and reference to the manuals will show that this code is coyly referred to as 'number' without further explanation.

23755	0
23756	10
23757	14
23758	0
23759	241
23760	97
23761	61
23762	49
23763	52
23764	52
23765	51
23766	14
23767	0
23768	0
23769	163
23770	5
23771	0
23772	13

Table 3. The form in which the line
10 LET a=1443
is stored in the program area.

The explanation notable in its absence is that numbers, excluding line numbers, in Basic programs are stored not once but twice in two forms. The first time they are stored they are in character form and we have already seen how to look up the codes in the programming manuals to obtain the relevant characters. The second time they are held in a numeric form, a form which the user is normally completely unaware of.

The numeric form always requires five bytes of memory. In our example the number is the whole number, or integer, 1443 and it is represented by the contents of the locations 23767 to 23771 which contain 0,0,163,5,0 respectively. The calculation to recreate a whole number from its five byte numeric form is

whole number = PEEK third location + 256★PEEK fourth location

In this case the third and fourth locations contain 163 and 5; a quick check shows that as expected

1443=163+256★5

Non-integer numbers are held in so-called floating point form as an exponent in the first location followed by a mantissa stored in the subsequent four locations. That is

number = mantissa ★ ↑ exponent

The first location of the mantissa is also used to determine the sign of the number.

If the location contains a value in the range 0 to 127 then the number is positive and if it is in the range 128 to 255 then the number is negative. Table four lists a short program to reconstruct a non-integer number from its five byte form.

Why does the Spectrum use this wasteful method of storing all numbers twice – a method incidentally – also used on the ZX-81? The answer is simply that it enables Basic programs to run rather faster than they otherwise would, because it is the five byte form which is used in all calculations and not the character form.

The creation of the five byte form takes place when the program line is first stored in memory and is therefore done once only for each line.

```
10 PRINT "Enter the exponent and the four bytes of the mantissa. All entries to lie between 0 and 255 inclusive."
20 INPUT e,a,b,c,d
30 PRINT ,,"Exponent =" ; e
40 PRINT "Mantissa =" ,a,,b,,c,,d
50 PRINT ,,"The number =" ; (2★(a<128)−)★ ↑ (e−160)★(((256★(a+128★(a<128))+b)★256+c)★256+d)
```

Table 4. A program to reconstruct a non-integer number from its five byte form.

A & F Software, Unit 8, Canalside Industrial Estate, Woodbine Street East, Rochdale, Lancashire OL16 5LB
Abacus Software, 21 Union Street, Ramsbottom, Nr Bury, Lancashire
Abbex, 20 Ashley Close, Manor Hall Drive, London NW4
Abersoft, 7 Maesfallen, Bow Street, Aberystwyth, Wales
Activision, 15 Harley House, Marylebone Road, London NW1
Adder Publishing Ltd, PO Box 148, Cambridge CB1 2EQ
Add-on Electronics, Units 2,3 & 4, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ
Addictive Games, 7a Richmond Hill, Bournemouth BH2 6HE
ADS, 8 Bronchurch Street, Portsmouth, Hampshire PO4 8RY
Alan Firminger, 171 Herne Hill, London SE24 9LR
Allanson Computing, 77 Chorley Road, Adlington, Chorley, Lancashire PR6 9LH
Alligata Software, 1 Orange Street, Sheffield S1 4DW
Argus Press Software, Liberty House, 222 Regent Street, London W1
Arcade Software, Technology House, 32 Chislehurst Road, Orpington, Kent BR6 0DG
Ariolasoft,Asphalt House, Suite 105-106, Palace Street, London SW1E 5HS
Arnold Wheaton, Parkside Lane, Dewsbury Road, Leeds LS11 5TD
Artic Computing, Main Street, Brandesburton, Driffield YO25 8RG
Astrocalc, 67 Peascroft Road, Hemel Hempstead, Herts HP3 8ER
Atlantis Software, 19 Prebend Street, London N1
Automata UK, PO Box 78, Southsea, Hampshire
Axis, 71 Brookfield Avenue, Loughborough, Leicestershire LE11 3LN
Beau-Jolly, 19A New Broadway, Ealing, London W5
Bellflower Software, 6 Rosewood Avenue, Greenford, Middlesex UB6 7QP
Betasoft, 92 Oxford Road, Moseley, Birmingham B13 9SQ
Beyond Software, Lector Court, 151 Farringdon Road, London EC1
Bridge Software, 36 Fernwood, Marple Bridge, Stockport, Cheshire
Bridgemaster, Sandymouth, Beeches Road, Farnham Common, Buckinghamshire SL2 3PS
Bubble Bus Software, 87 High Street, Tonbridge, Kent TN9 1RX
Calpac Computer Software, 108 Hermitage Woods Crescent, St Johns, Woking, Surrey
Campbell Systems, 57 Trap's Hill, Loughton, Essex 1G10 1TD
CCS, 14 Langton Way, Blackheath, London SE3 7TL
CDS Micro Systems, Silver House, Silver Street, Doncaster, South Yorkshire DN1 1HL
Century Communications, Portland House, 12-13 Greek Street, London W1V 5LE
Chalksoft, 17 Willowslea Road, Northwick, Worcester
Cheetahsoft, 24 Ray Street, London EC1R 3DJ
Clever Clogs, Liberty House, 222 Regent Street, London W1
Collins, 18/20 Stephenson Way, North Gower Street, London NW1 2DX
Collins Soft, 8 Grafton Street, London W1
Compusound, 32/33 Langley Close, Redditch, Worcester B98 0ET
Computatutor, 3 Thalia Close, Greenwich, London SE10 9NA
Computer One, 32 Science Park, Milton Road, Cambridge CB4 4DH
Contrast Software, Warren Road, Liss, Hampshire GU33 7DD
Cornhill Software, 2 Penrith Way, Aylesbury, Buckinghamshire HP21 7JZ
CP Software, 1 Glebe Road, Uxbridge, Middlesex UB8 2RD
Craig Communications, PO Box 46, Basingstoke, Hampshire
Creative Sparks, Thomson House, 296 Farnborough Road, Farnborough, Hampshire
CRL, 9 King's Yard, Carpenters Road, London E15 2HD
Cross Software, 72 Swanshope, Burney Drive, Loughton, Essex
CSP Systems, 213 Stainbeck Road, Leeds
DACC Ltd, 23 Waverley Road, Hindley, Wigan, Lancashire WN2 3BN
Database Publications, Europa House, 68 Chester Road, Hazel Grove, Stockport, SK7 5NY
Delta 4, The Shielding, New Road, Swanmore, Hampshire SO3 9PE
Design Design, 2 Ashton Way, East Herrington, Sunderland SR3 3RS
Digital Integration, Watchmoor Trade Centre, Watchmoor Road, Camberley, Surrey GU15 3AJ
Digital Precision, 91 Manor Road, Higham Hill, London E17
DK'tronics, Unit 6, Shire Hill Ind Est, Saffron Walden, Essex CB11 3AQ
Domark, 204 Worple Road, London SW20
Dorcas Software, 3 The Oasis, Glenfield, Leicester
Dunitz, 154 Camden High Street, London NW1 0NE
Durrell Software, Castle Lodge, Castle Green, Taunton TA1 4AB
Dymond Software, 22 Hospital Road, Annan, Dumfriesshire DG12 5HP
Dynavision Production Studio, PO Box 96, Luton LU3 2JP
East London Robotics, St Nicholas House, The Mount, Guildford, Surrey GU2 5HN
Eastmead, Eastmead House, Lion Way, Camberley, Surrey GU16 5EZ
8th Day, 18 Flaxhill, Moreton, Wirral, Merseyside LU6 7UH
Electric Abacus, Oaklands House, Solartron Road, Farnborough, Hants
Elite Systems, Anchor House, Anchor Road, Aldridge, Walsall, West Midlands WS9 8PW
Elm Computers, 59 Bateman Road, East Leake, Loughborough, Leicestershire LE12 6NN
Englefield Software, High House, Mill Street, Buxton, Norfolk NR10 5JE
Fantasy Software, Fauconberg Lodge, 27a St Georges Road, Cheltenham, Gloucestershire
Fawkes Computing, 41 Wolfridge Ride, Alveston, Bristol BS12 2RA
Felix Software, 19 Leighton Avenue, Pinner HA5 3BW
Firebird Software, Wellington House, St Martins Lane, London WC2
Fisher Software, 47 London Road, Buxton, Derbyshire
Fulwood, 20 Templestowe Hill, Whitkirk, Leeds LS15 7EJ
Games Machine, 40 Fretherne Road, Welwyn Garden City, Hertfordshire AL8 6NU
Gamma Software, 12 Milverton Road, London NW6 7AS
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Manor Software, 24 Manor Gardens, London SW20
Martech Games, 9 Billingburgh Road, Eastbourne, East Sussex BN20 8LY

continued on page 110

Software Publishers

continued from page 109

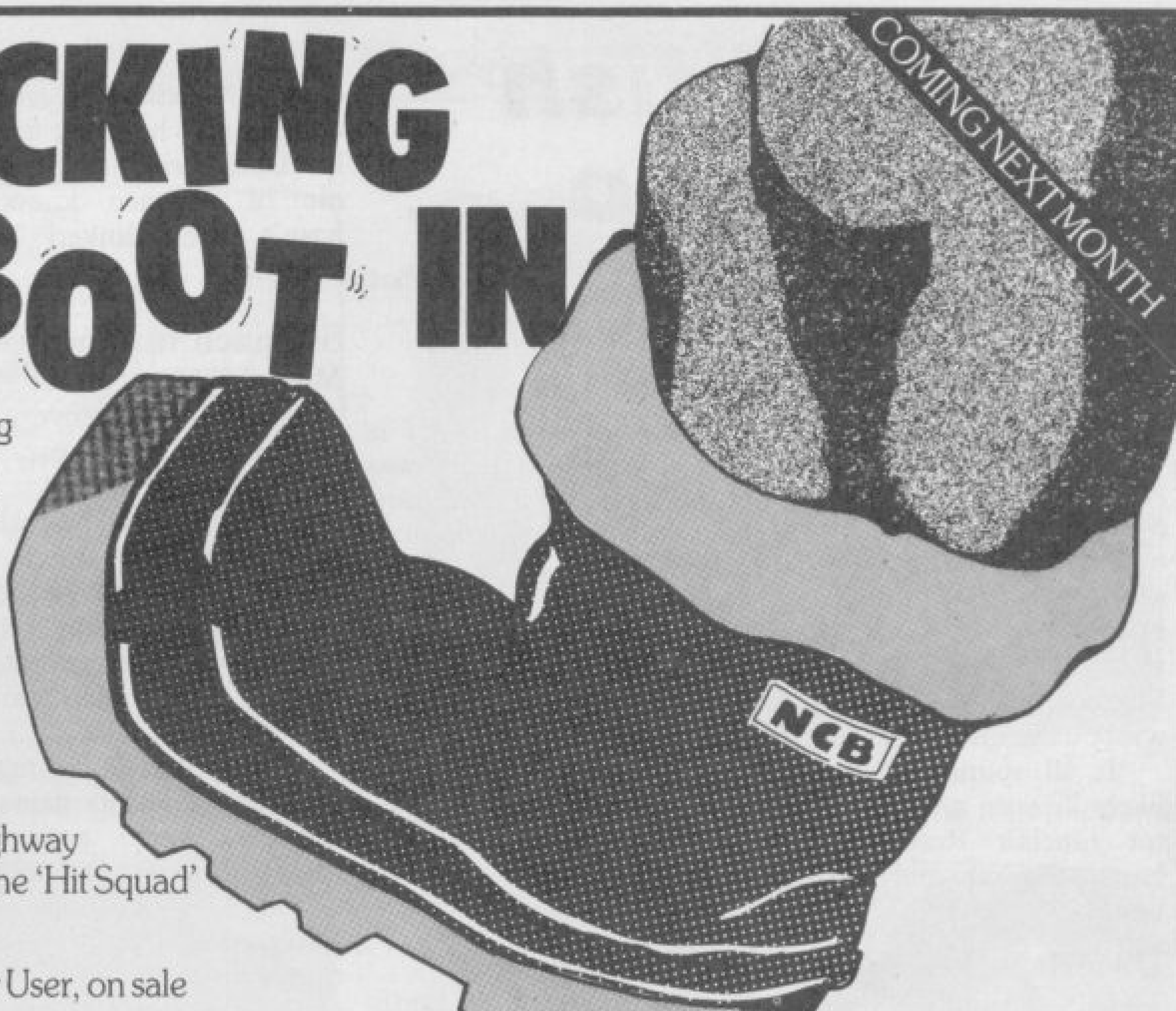
Mastertronic, (as for Mastervision)
Mastervision, Park Lorne, 111 Park Road, London NW8 7JL
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Price of fish is going up. . .

SIR CLIVE is well-known as a patron of the arts. He was invited to the launch of *So Long and Thanks for All the Fish* by **Douglas** 'Hitchiker' **Adams**, and, so the story goes, he tried to buy a copy on the spot. Since the organisers were running short they suggested he bought one the next day. "I want it now" demanded **Slugger**, and promptly wrote a cheque for £1000.

"It all sounds most unlikely," says a spokesman for Sinclair Research. "I hope the cheque didn't bounce.". . .

Hi-tech raffles

The **C5** is rapidly becoming a market leader – as a raffle prize. A party at the flash



Kevin Toms, who wrote Football Manager, and not much else, congratulates Laurie McMenemy on drinking 17 pints of Barbican without throwing up.

Hippodrome nightclub in London had a pink C5 as a prize, apparently because the do was a 'Pink Hippo' party. The mind boggles. But the peripatetic trike aspired to even greater fame as a star guest at the Woman's Conservative Conference at the Barbican.

There can be no greater accolade in the world of raffles than to have a horde of imposing Tory ladies jostling for a ticket. The C5 has clearly made it at last . . .

Hail and farewell

Personal Computer News is dead. The weekly paper was publisher VNU's last foothold on the home computer market, and it seems to have taken a while to make up its mind. "It's the fourth time we've folded, so we're getting pretty hardened to it," says features editor John Lettice. "You want me to say something really tacky but I won't. We're ★★@$ed off.". . .

Duffy breaks vow

Paul 'Trappist monk' **Duffy** – Gremlin, May – has resigned as general secretary of the **Guild of Software Houses**. "A purely amicable arrangement," says chairman **Tim** 'mega' **Langdell**.

Meanwhile, let's set the record straight on Duffy. The Silent One also says he didn't 'leave' Prism, he was sacked. And sued them. And got some dough.

Gremlin knew all that, but was too tactful to say so at the time. For the record, Paul resigned from GOSH. Until he tells us otherwise, of course . . .

Full of beans

Khan of Khans **David Ward**, emperor of **Ocean** and all its islands, takes a break from one of his 73 day meetings to confirm another tale of his colourful past. This one concerns his great scheme to manufacture unusual coffee percolators in Poland at five pence a time and flog them on the streets of Liverpool.

"Cafatierès," says David, and changes the subject. It appears he's been ski-ing recently in exalted company. "My name has not been linked with any of the crowned heads of Europe's daughters," he says, smugly. Does **Princess Stephanie** of Monaco know it hasn't been linked with hers, too . . .

Stomach turning

Mastertronic writes to announce its discovery of the back of crisps packets, and thereby wins the month's **Brazen Backslappers Award**. So watch out for **KP Skips** and the fabulous **Clumsy Colin** Action Bike model you can get by sending off 342 empty packets.

Mastertronic is joining in with an ad for its game of the same name, appearing on 12 million packets of what a KP spokesperson described as "small round things."

The **Clumsy Colin** game and KP Skips will both be on sale at grocers," says Mastertronic, describing this as a happy coincidence.

Gremlin fully understands the wisdom of the deal. KP Skips is probably the only product which tastes worse than a Mastertronic budget special . . .

Sinclair at war

Unlikely customers for the QL pop up everywhere. **Four Systems**, which offers cut-price microdrive cartridges to purchasers of its Cartridge Caddy storage box, proudly announces its status as a 'supplier to the Ministry of Defence'.

So what is **Heseltine** doing with all these QLs,



David Ward, Shogun of Ocean, takes on Kenji Hiroaka of arcade firm Konami at the ancient Japanese game of 'honourable bone-crushing'. David is the one on the right.

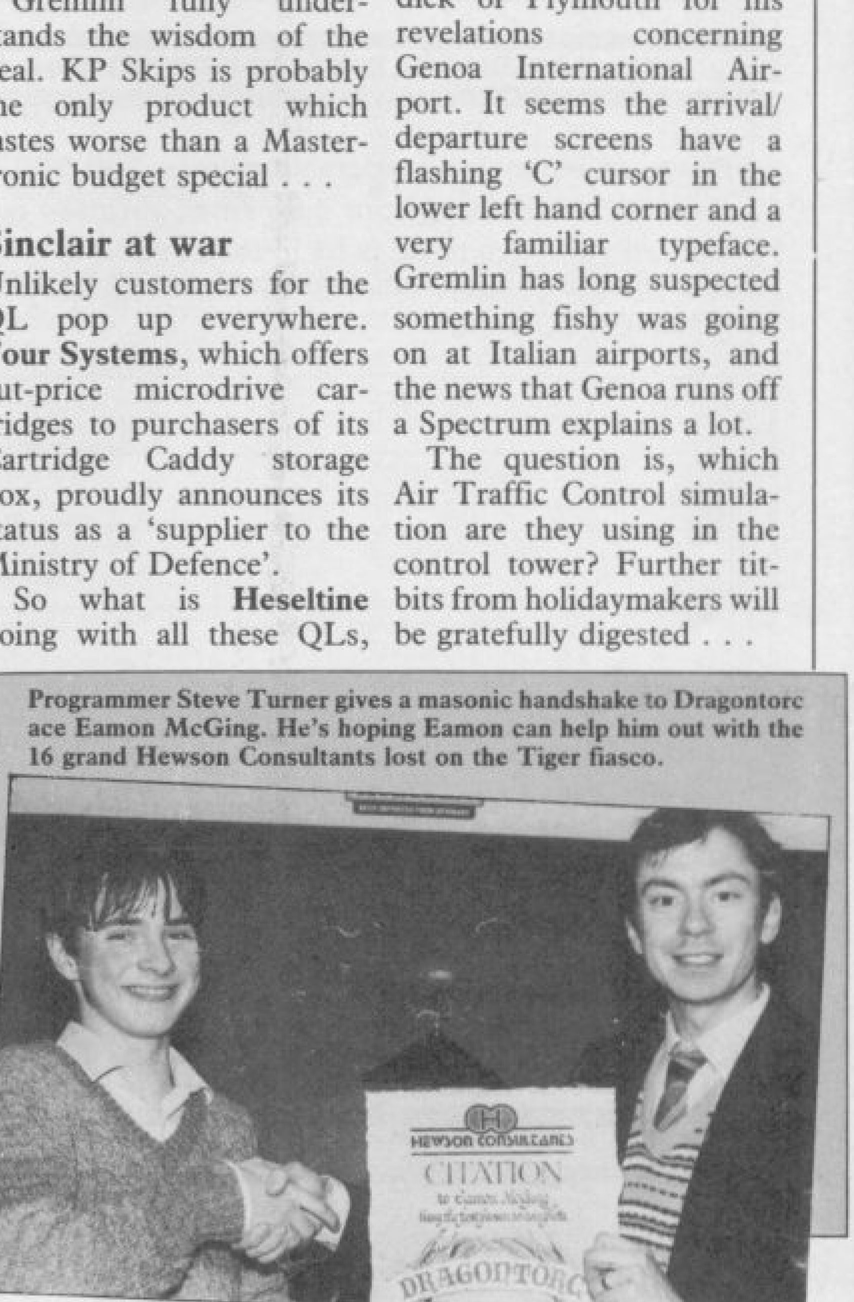
asks Gremlin. Is the machine an integral part of the cruise missile procedure – 'make sure formatted bomb is present in drive two'? Or does **Tarzan** simply hope all important data will become hopelessly and irrevocably corrupt long before any civil service moles can get their paws on it . . ?

Italian connection

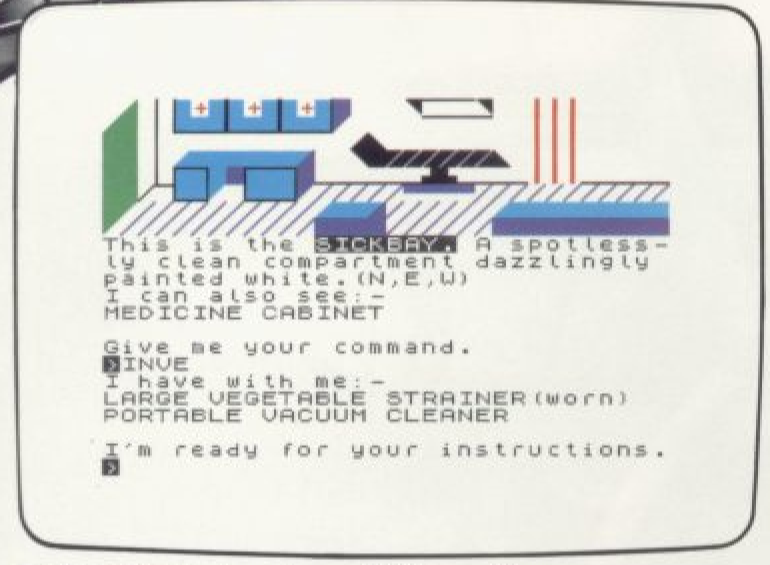
Finally, thanks to K Riddick of Plymouth for his revelations concerning Genoa International Airport. It seems the arrival/departure screens have a flashing 'C' cursor in the lower left hand corner and a very familiar typeface. Gremlin has long suspected something fishy was going on at Italian airports, and the news that Genoa runs off a Spectrum explains a lot.

The question is, which Air Traffic Control simulation are they using in the control tower? Further titbits from holidaymakers will be gratefully digested . . .

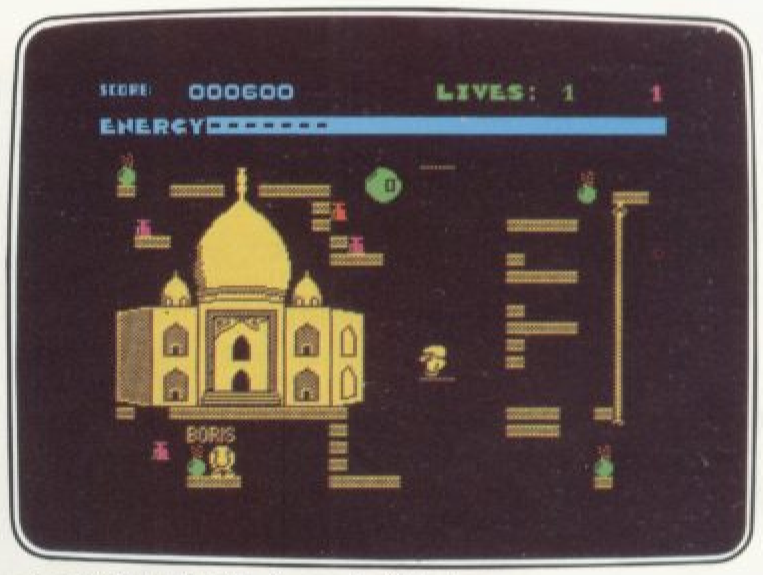
Programmer Steve Turner gives a masonic handshake to Dragontorc ace Eamon McGing. He's hoping Eamon can help him out with the 16 grand Hewson Consultants lost on the Tiger fiasco.



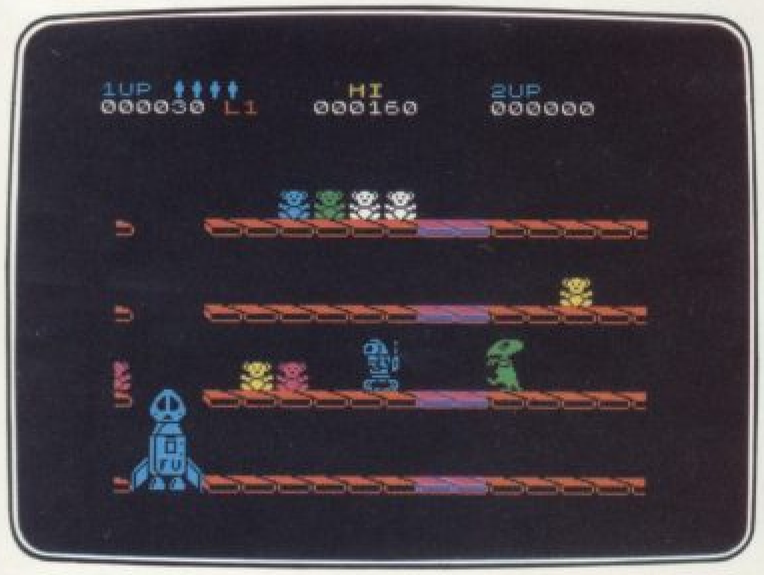
SILVER RANGE . . . Seeing is believing



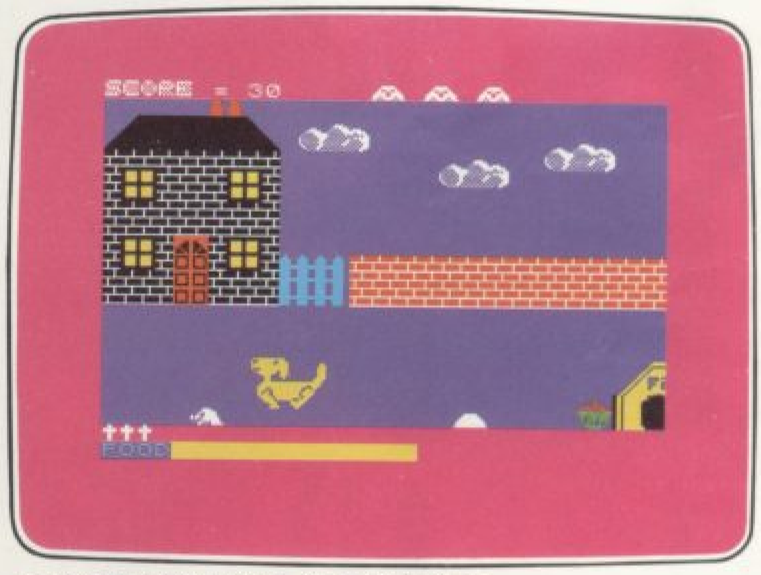
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